

► State-of-the Art
Lightweight PCs:
Mini-Notebooks
Vs. CE Devices



● Great Sound:
Hot Technologies
To Fire Up Your
Computer Audio

● In After Hours:
Enhance Your
Cooking Skills &
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● User to User:
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● Remote Access:
PC Labs Tests
5 New Servers

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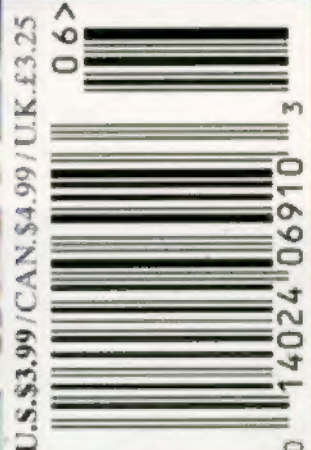
- 400-MHz Celeron And K6-2 PCs
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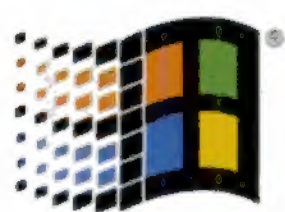
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The Net Changes Everything

We all know the Internet has changed computing. It changed the reasons we buy computers in the first place, as well as the machines themselves, the applications we run, and the way we set up our networks. But the Internet is changing much more than that. It is changing the ways we communicate, get information,

entertain ourselves, and run our businesses.

In short, the Internet is changing *everything*.

Communication, the core of the Internet, is changing. More electronic mail is now sent annually than snail mail. A lot of that e-mail is business-related; its effects are changing how we run our companies. But it's also changing personal communications. Newsgroups, chat rooms, and other community sites are becoming important ways to exchange information and interact with others. I write many more personal e-mails to friends than traditional letters, and I bet you do too.

Gathering information is changing. The Internet makes a nearly infinite amount of information available for a very small price and lets us get it very quickly. This is a major change from the time when information was often difficult and expensive to attain. We now have more data available, but the sheer quantity will force us to be more selective and more skeptical about much of the information we do gather.

Entertainment is changing. Many Web sites provide entertainment, and for some people, this is replacing television. More people are not only playing games on their computers, they are using the Internet to play these games with friends and acquaintances all over the world.

But no area is changing more than business. Direct sales via catalog or telephone have been a growing part of the economy for years, but the Internet has accelerated this trend. By the holiday season of 1997, a lot of us had tried shopping online. By this past holiday season, it seemed as if everyone was buying online, not just those of us on the leading edge of technology. This is having a profound effect on business, and it will have more in the years to come.

Amazon.com was the first that fully understood how any business that has a huge database of products can deliver those products more efficiently without the overhead of physical storefronts. For things like books and records, the Internet offers a much

larger selection, and this is expanding into many other areas. But now traditional stores must focus more on their advantages—instant gratification and the social experience of shopping.

Our perception of pricing is changing. Stores have had low-cost guarantees for a long time, but prices had been hard to check. Now with shopping “bots” that search the Internet for the lowest prices, it's easy to find the best deal. This means anyone with significantly different costs is going to have to make sure that difference is reflected in services that provide real value for customers.

One such service will be more personalized information. Already, dozens of sites offer start pages, information on stocks, or recommendations on music or books. In addition, you'll see sites offering better services and better prices to their best customers, along the lines of airline frequent-flier programs. Internet technology will let almost every business do this.

Online shopping is changing other things as well. Auction sites such as eBay and Onsale have suddenly turned lots more people into buyers and sellers, which is changing both the economy and people's personal lives. I know people who are nearly addicted to these sites, checking them out multiple times every day to track their bids, and buying things they don't really need.

One change caused by the auction sites is our perception of pricing. If pricing can be negotiated there, it can be negotiated anywhere. There are sites such as Priceline.com where you can enter a price and see if someone will offer you what you want for that price. We seem to be moving from an era of fixed pricing to an area of real-time pricing, where everything is subject to change.

In recent weeks, online shopping has gotten a lot of attention. But that's just the tip of the iceberg. From how we shop to how we learn, communicate, and get entertained, the Internet is changing everything. **PC**

**The Internet
is having a
profound effect
on business,
and it will have
more in the
years to come.**



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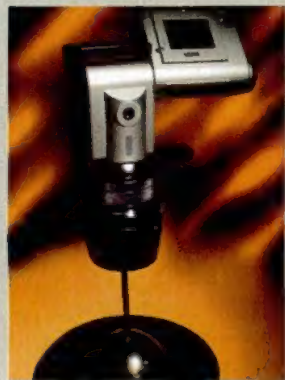
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COVER STORY

BY DON WILLMOTT

The Web knows no limits. So we're back again to give you some help when you're sorting through all those sites. This year, we've expanded our list of categories from 5 to 20. From auctions to enter-



tainment to sports to travel, we've hit many different aspects of your computing life online. You're bound to bookmark lots of these sites—and we know you'll want to weigh in at our Web site with your own favorites....100



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PCs

State-of-the-Art Lightweight Portables

BY BILL HOWARD

Before you buy any Windows CE device, think about one of these. We tested four new 2.5-pound devices that look and act like further downsized mini-notebook PCs. And we looked at six 3-pound mini-notebooks that run the real thing: Windows 98. These are very intriguing PC categories, with some cool designs on display, but some still seem to be works in progress146



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PC SOUND

Hot Technologies for Computer Audio

BY WILL PIRKLE AND KEN C. POHLMANN

You may think you've heard everything, but you haven't. So-called 3-D sound, or positional audio, is the hottest thing going in PC sound today. But changes in audio are coming on other fronts as well—improved quality, the debut of USB audio, and the march to PCI. We explain what it's all about and show you how the competing 3-D sound technologies compare177

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NETWORKING

Remote-Access Servers



BY LES FREED

Think of it. The office. Being there without actually being there. For some users and their places of business, it works. Remote-access servers let businesses give remote users that option. And these devices come with graphical management software, making installation and configuration easier than in the past. It may be time for you to "go remote."188

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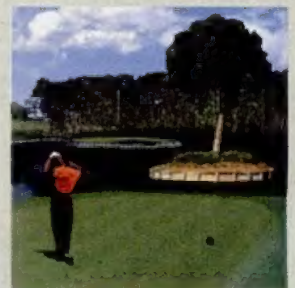
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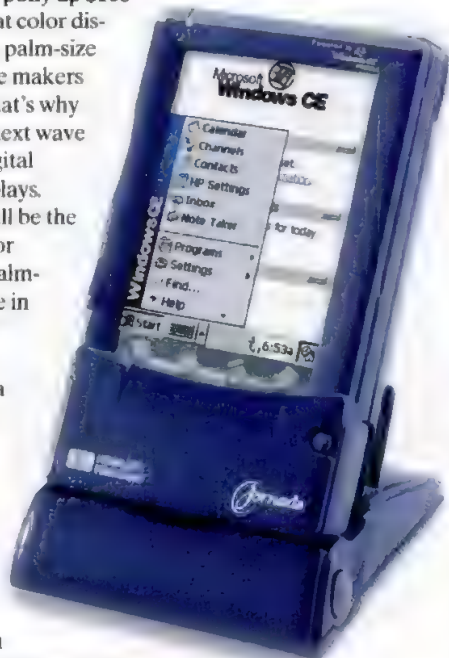
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Now in Color!

Would you pony up \$100 for a great color display on a palm-size companion? Hardware makers are betting you will. That's why they're designing the next wave of these diminutive digital devices with color displays.

Hewlett-Packard will be the first to introduce a color Windows CE-based palm-size PC. To be available in late February for \$499 (list), the 8-ounce HP Jornada 420 will have a 256-color, 320- by 240-pixel display that HP says will be easy to view in even the most subdued lighting. (HP decided to skip a monochrome version altogether.) In addition to focusing on display improvements, HP has designed the Jornada 420 to work hand-in-glove with the Motorola CF1350 Compact Flash FLEX Pager for receiving stock quotes, traffic reports, and news updates.

Other manufacturers plan to introduce color models of their Windows CE hand-helds in the coming months. The move to color displays may also bring about improvements in readability on small screens. Microsoft recently introduced a technology called Clear-Type, which uses subpixel techniques to sharpen text and graphics displayed on color screens.

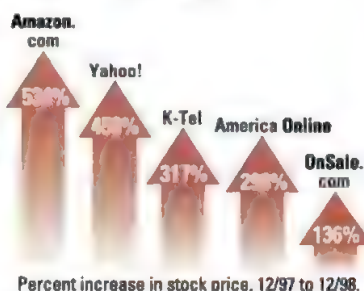


Internet Stock Frenzy

Online sales of all kinds of wares soared over the holiday season, but nothing skyrocketed like the shares of Web sites selling those wares. The year 1998 produced such a frenzy in Internet stocks that several major brokerages, including Ameritrade, E*Trade, and Charles Schwab imposed special account-maintenance requirements on individual investors purchasing Internet stocks with borrowed money. "We're saying to investors that they have to wear seat belts," warns a statement from Schwab.

Usually institutional firms make up the majority in buying any particular stock, but data from Bloomberg shows that during 1998 individual investors did most of the buying of Internet shares.

Many investment analysts have bemoaned the fact that a number of high-flying Internet stocks are in companies that haven't shown profits.

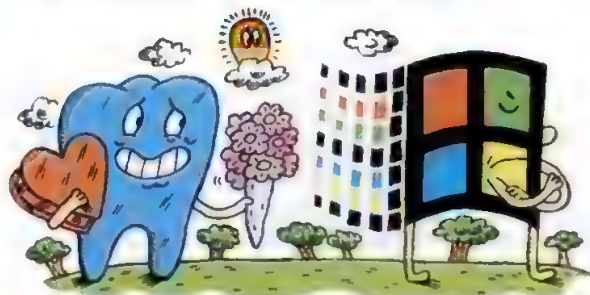


61%

of respondents to a recent PC Magazine Online poll told us they had never had any viruses on their PCs. Another 33 percent said that the viruses they had suffered had been harmless distractions, while only 6 percent said that viruses had disabled their PCs many times.



The Bluetooth Blues



Bluetooth, a technology that uses short-range radio signals to exchange data between electronic devices, is poised to attract lots of headlines this year. Though only a specification now, it has the backing of more than 200 industry players.

An onslaught of Bluetooth devices—from hand-held PCs to digital cellular phones—is expected in late 1999. A few dark clouds are taking shape on Bluetooth's horizon, however; the most notable being that Microsoft hasn't joined forces with the founders of the specification—Ericsson, IBM, Intel, Nokia, and Toshiba—nor given

approval to the standard.

Currently the Bluetooth Special Interest Group requires members to relinquish intellectual-property rights to Bluetooth technology, which may be what Microsoft is balking at. Without Microsoft's backing, Bluetooth may not get Microsoft logo approval.

Other organizations, including the Federal Aviation Administration, are concerned about Bluetooth as well. The technology uses the same bandwidth frequency that several local wireless technologies use, which could mean data collisions and lost data.

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The Top 100 Web Sites

Do you agree with our new list in this issue's cover story? Want to nominate your own site? Talk back online to let us know.

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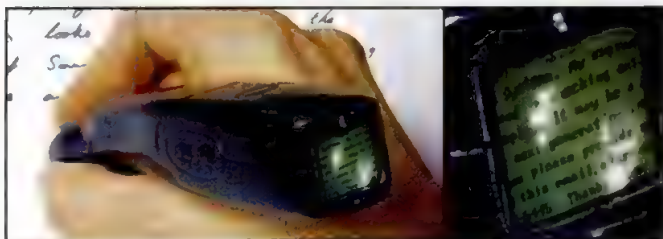
Check in with our cantankerous columnist each week for his news, views, and snide asides about the world of the Internet.

Pens That Read and Speak

British Telecom (BT) recently demonstrated the SmartQuill, a proof-of-concept pen-size personal data assistant that stores contact and appointment information as well as recording your handwriting for uploading to a PC.

Using a pair of transducers, the pen senses the movements you make while writing, stores the motion data in memory, and then uploads it to a PC when you place the pen in its "inkwell"—a docking station. The motion data is then converted to text.

Instead of identifying character shapes, as optical character recognition software might, the SmartQuill uses a voice-recognition engine to analyze the motions, matching the patterns you use to create different letters. One model has a two-line LCD panel



SMARTQUILL: British Telecom is developing a pen that records handwriting.

that you can scroll through by tilting the pen. The executive model has a micropanel CyberDisplay from Kopin Corp. mounted in the end of the pen.

The SmartQuill comes with 4MB of memory—enough to store about 40 pages of handwriting—and runs for 25 hours on a single triple-A penlight battery. BT is looking for a manufacturing partner to refine the product and bring it to market. You could be carrying a SmartQuill in your pocket before the end of the year.

In another twist on pens, WizCom Technologies, based in Jerusalem, has developed the Quicktionary Reading Pen, a handheld scanner that reads text, defines it, displays it on a small screen, and even reads it aloud. Designed for dyslexics, the pen-shaped device contains 200,000 definitions and stores up to 100 scanned words.



Java: License With a Smile

Sun Microsystems's recent move to liberate Java from strict licensing requirements promises to make Java software development easier and cheaper for programmers. Sun will now let developers use and modify Java source code without charge, striking royalty agreements only when products are commercialized. "Our goal has always been to foster industry participation in the usage and development of the Java technology while preserving a unified platform," says Alan Baratz, president of Java Software at Sun. "The new model... guarantees far more rapid innovation than ever before possible."

More than a few Java developers are applauding the move. Talks regarding a specification for real-time Java for embedded systems—pagers, cellular phones, and even the computers that run the fuel-injection system in your car—broke down recently when Hewlett-Packard accused Sun of exerting too much control over the process.

Top-Selling Retail Software

- 1 Deerhunter II 3D GT Interactive
- 2 Barbie Riding Club Mattel
- 3 Microsoft Windows 98 Upgrade Microsoft
- 4 Blue's ABC Time Activities Humongous Entertainment
- 5 Tomb Raider 3 Eidos
- 6 Blue's Birthday Adventure Humongous Entertainment
- 7 Cabela's Big Game Hunter 2 Activision
- 8 Microsoft Combat Flight Simulator Microsoft
- 9 Play with the Teletubbies Cendant Software
- 10 Microsoft Encarta Encyclopedia Microsoft

Source: PC Data; data for November.

Countdown

Microsoft is set to join the armies of software providers aiming to fix year 2000 problems. In the first half of 1999, the company plans to introduce a series of products and services designed to help companies check and fix their systems. The products will analyze hardware, operating systems, applications, and documents.

The offerings will arrive much later than many of the tools currently available, but questions had been swirling about whether the biggest software provider would join the Y2K effort.

Groceries for Geeks

Tired of wandering around the grocery store? Food retailer Safeway is testing a new palm-size personal organizer it has developed, with shopping software developed by IBM. The organizer, which is being tested in England, lets customers order groceries online. Customers select grocery items from lists based on their historical shopping prefer-

ences. The orders are sent over the Internet to a central computer, and the groceries are made available at the local store for pickup. So don't be late if you ordered ice cream.

The new palm-size device may join Peapod (www.peapod.com) in encouraging consumers at large to shop electronically. Peapod delivers groceries straight to your door.



Just How Wide Is the Web?

The number of Web users will grow at a compound annual growth rate of 26 percent, reaching 227 million by 2001, predicts market research firm IDC. There will be multiple Internet devices per user as the number of non-PC access devices grows over the next few years.



THIS ISSUE'S CONTRIBUTORS: Angela Hickman, Carol Levin, Alfred Poor, Sebastian Rupley, Don Willmott.

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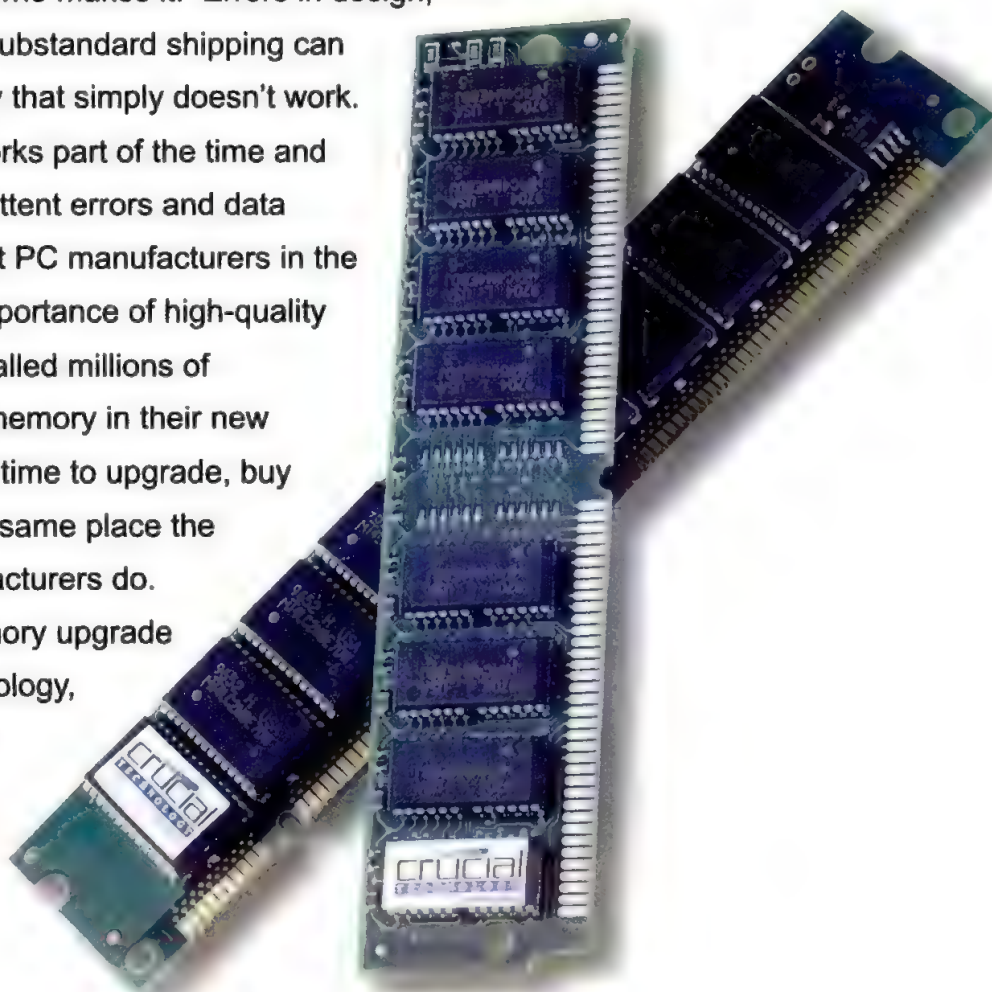


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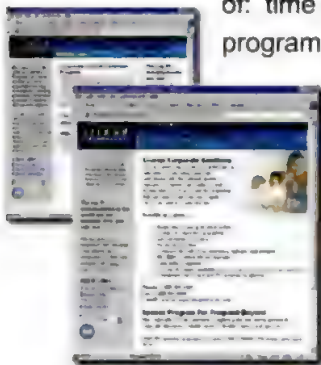
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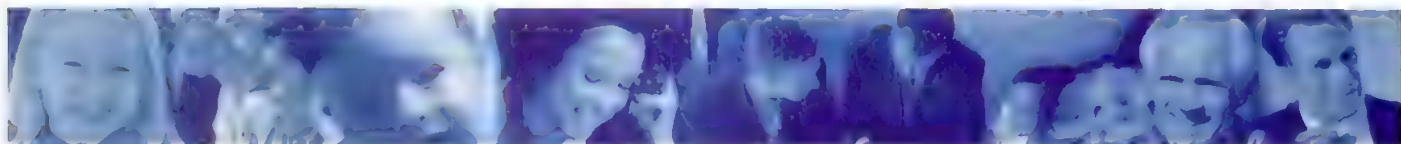
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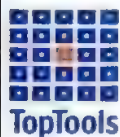
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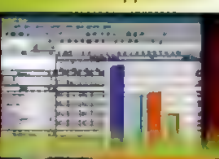
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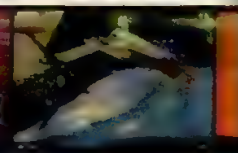


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LETTERS

UNIQUE UNIX

Regarding "Unix in the Cross Hairs" (Pipeline, December 15): Though I'm a Unix system administrator, I use Windows 95 myself and like it. After all the hoopla predicting the death of Unix, I looked at the new Windows NT installations in our shop, hoping for a sign that Windows NT was good enough for enterprise prime-time. But it just isn't industrial-strength. Every day, there's another horror story: the printer server that hangs up overnight, the name server that has all sorts of inconsistencies with standard Unix protocols on the Web, the Windows NT Service Pack that worked fine on the printer server but totaled the mail server. With good (and yes, expensive) Unix hardware and software, you get stability; harnessed, effective power; fantastic reliability; and integrated functionality.

STEWART DEAN
via the Internet

HIS NEXT MODEM

I had looked forward to reading "Your Last Modem?" (December 15). The 3Com U.S. Robotics Courier V. Everything was named the Editors' Choice. At \$240 list, it had better be. I cannot spend that kind of money on a modem, though, and wouldn't even if I could. My next modem, like all the peripherals I buy, will be reasonably priced, probably from an online auction site, and far away from the land of \$2,300 monitors and \$600 scanners.

ED STEVENSON
via the Internet

HOLD THAT TIGER

Your roundup of home PCs ("Great Home PCs," December 15) did not include a TigerDirect product. This company's PCs are typically far less expensive than competing systems yet offer good features. A few months ago I bought a TigerDirect computer for my daughter. It's not a power-user machine, but it didn't stint on the cache, RAM, or bus clock. It ran flawlessly right out of the box and, except for the sound system, is comparable to my Dell Dimension XPS D266.

EDWARD HUME
via the Internet

TAMING THE REST OF THE PC JUNGLE

I agree fully with your observations and recommendations concerning DMI ("Taming the PC Jungle," December 1). Without a specific MIF for each type of hardware we have, DMI does not do us much good. Many industry people believe that in mid-1999, DMI compliance will fade away and be replaced by WBEM compliance, and even that WBEM will replace DMI as the instrumentation layer for the Wired for Management standard.

I was disappointed, though, to see that the

article focused only on conventional LAN-based management utilities. It is becoming more difficult to label someone as a traditional LAN-based user or a mobile user. For example, I am LAN-based 75 percent of the time and mobile the rest of the time. Supporting someone like me is next to impossible with traditional desktop management suites.

To evaluate strategic solutions, you might consider the following criteria: The solution should be NOS-independent, work for mobile and LAN-connected users, be directory-enabled (LDAP), provide self-healing, supply updates or changes in software distributions, allow for push or pull distribution, perform complete inventory (WBEM), and be almost self-managing.

MIKE OWENS
via the Internet

Unix hardware and software give you stability, power, and reliability.

Thanks for your insightful message. Right now, DMI is what we've got, and we don't think that using DMI tools now will block the adoption of new standards. As bandwidth for mobile users increases, and particularly as VPNs proliferate, the distinction between LAN-connected and dial-up users will blur. Bet on bandwidth.—Ed.

DIY IS ON THE WAY

Your article "Online Music Chaos: Blame It on Rio" (Trends, December 15) only briefly touched on the real reason the RIAA and major record labels are so opposed to MP3 technology. It's true that they will lose royalties from people copying CDs for their friends and distributing them on the Internet. But this will not be a significant loss. What they are scared of is losing control of the music industry. MP3 and the Internet have made it possible for artists to bypass the major labels and record, market, and distribute their music in a very cost-effective manner. The day is almost here when artists will no longer have to wait for their big break to land a contract with a major label. Instead, they will simply distribute their music themselves over the Internet.

DENNIS BRONSTEIN
Chicago, Illinois

The flow chart at the top of the page seems to indicate that to transfer any music to the Diamond Rio, a user has to upload it to the Internet first and then download it himself. For the majority of legitimate Rio users, the Internet

will never be a step in transferring music to the Rio. A user simply has to rip the audio data from a music CD he owns, encode it in MP3 format, then copy the files from his computer to the Rio via a serial cable.

You also quote RIAA president and CEO Hilary Rosen as saying that Diamond can profit from illegal music distribution—"music that the Rio helps users copy." Saying that the Rio helps users copy music illegally is like saying that the cassette deck in your car helps you tape CDs illegally.

JAY MCGRATH
Austin, Texas

COMPUTER EASE

Regarding Michael J. Miller's column "Easing into the Future" (December 15): When you talk about ease of use in software, the most vexing problem is weird error messages. There is a valid reason behind every error screen that pops up in a software program; the messages don't just come from nowhere. But it's not always clear why they appear. I would like to see a comprehensive list (perhaps on the program's CD-ROM) of every possible error message you might see when using a program, what may be causing it, and what may fix it. That would really improve ease of use.

HOWARD WEXLER
via the Internet

I applaud your recent emphasis on ease of use. The industry has a long way to go. One aspect I haven't seen discussed is the ease of switching from an old to a new computer. I'm certain that new PC sales would increase dramatically if users could easily configure new PCs with software and interfaces from their existing machines. Those of us who have had the experience of switching machines dread the painful week or more it requires. One possibility would be software that reliably and simply transfers all the hard disk contents from the old computer to the new.

DAVE FAIN
via the Internet

Where does Miller hear these complaints about how hard PCs are to use? He should know that most people do not read manuals or help files. He's blaming the PC industry for users' lack of motivation. Also, most of the points Miller makes seem to be about the user interface to the PC hardware—the software. Many problems are encountered by novices



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installing and uninstalling various software without knowing what it is doing to their operating system. Miller concludes his article by suggesting that we demand more from the PC makers. This kind of thinking is what drives six-month obsolescence.

RICK McNABB
via the Internet

THE MIGHTY PEN

Bill Machrone ("Remember Pen Computing?", December 15) made reference to the Dauphin Orasis pen computer, whose specifications are amazing. But I was surprised that Machrone did not mention another popular pen-based solution: the Fujitsu Stylistic series. These pen computers are fairly popular, especially in the health care industry. Although they don't have keyboards, many software solutions are designed for such computers, eliminating the need for an external keyboard.

DENNIS DEVEAUX
Calgary, Alberta, Canada

A MAVICA FAN

I must comment on John C. Dvorak's remarks concerning the Sony Mavica (Inside Track, December 15). I think he may have underestimated its most appealing feature: the use of standard floppy disks as the storage medium. My staff of about 40 researchers regularly go into the field to evaluate wetlands, historic resources, endangered species, and so on. They shoot thousands of photos. If they used Olympus digital cameras, I would have to install proprietary software on each of their computers, and they would have to use special cables to connect the cameras to their machines for downloading. Yes, other digital cameras can produce higher-quality prints, but we purchased the Mavica because it offers extreme ease of use and requires no training,

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We welcome your comments and suggestions. When sending e-mail to Letters, please state in the subject line of your message which article or column prompted your response.

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MAIL Letters, PC Magazine

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New York, NY 10018-5802

All letters become the property of PC Magazine and are subject to editing. We regret



that we cannot answer letters individually. To send submissions for PC Solutions, please see the sidebar "How to Contact Us" on the last page of that column.

Corrections and Amplifications

In our story "Latest and Greatest: Color Laser Printers" (First Looks, December 15), the output photos for the HP Color LaserJet 4500 DN and the Tektronix Phaser 740 Extended were reversed.

In our review of Netscape Communicator 4.5 (First Looks, December 15, page 60), we incorrectly stated that both IE 4.0 and Communicator lack the ability to import/export bookmarks. In fact, both can do so.

In our review of General Magic's Portico ("At Your Service," First Looks, December 15, page 71), we incorrectly implied that the product's voice greets users with the statement "I thought you'd never call." This greeting is used in a product from Wildfire Communications.

special software, or cables. I think you were a tad unfair to this wonderful gizmo.

JAMES NORMAN
via the Internet

DECISIONS, DECISIONS

I read "Rating PC Companies" (December 1) with great interest, since I am presently searching for the best company from which to purchase a laptop. After I had talked to several vendors, I knew what was missing from the survey: a rating of sales representatives. One I spoke to was not even aware of the two different types of processors that a certain series of laptops comes with. A rating of sales employees would be very helpful when this survey is run in the future. After all, how can a PC company be the best if its own people don't know what they are selling?

JOHN CRESSWELL
via the Internet

The recent article about service and support policies gives readers a good start in finding the most reliable companies but fails to emphasize one important point: Many of the smaller companies use outside contractors to provide extended warranties. This is a horrible system that results in a lack of accountability and responsibility. The computer manufacturer simply passes the buck to the service contractor, which in many cases subcontracts its work out to smaller repair firms. Buck passing increases exponentially. I sent a laptop for repair to the company that handled the extended warranty on my machine. It took ten days to get a return authorization and over two months to replace the motherboard. I will stick with major suppliers that do their own work. They seem a lot more concerned about end-user satisfaction.

MARC WEISSBURG
Atlanta, Georgia

WIPEOUT

Regarding "Netscape Moves In on Microsoft" (First Looks, December 15, page 60): When you review an upgrade to an existing version of a product, perhaps you should discuss what the upgrade does to the user's customized settings. Case in point: Netscape Communicator 4.5. You gave it a rave review. But if you are upgrading to this version, watch out: It destroys all your plug-ins. For a casual Internet user, this is no big deal. But if you use the many avail-

able plug-ins that enhance Netscape, such as RealAudio and RealVideo, QuickTime, and ShockWave, to name just a few, you are in for a massive reinstallation project.

HOWARD WEXLER
via the Internet

JUST MAKING SURE...

In your story "Who's the Fastest?" (December 1), the review of the ELSA Erazor II video card says, "Text was also a bit harder to read than with some other boards, as with other TNT-based cards." Are you referring to text within 3-D games only or ordinary 2-D applications, such as Microsoft Word, Excel, and so on?

SHELDON SHUGARMAN
via the Internet

Our apologies if we were less than clear: Text displayed in 3-D games was a bit hard to read. Text in 2-D productivity applications such as Microsoft Word and Excel was fine.—Ed.

NO NEED FOR GIGABIT SPEED

What was John C. Dvorak thinking when he wrote, "I'm seriously looking into gigabit Ethernet" (Inside Track, December 1)? What could he be doing that would take more than 10 Mbps? I run on a four-node 10-Mbps network at home, which I set up from used parts for about \$50. It works better than anything I could have imagined. Granted, I'm running only file and print sharing and the occasional multiplayer game, but this is more than most people run.

KARL GUTWIN WILLISTON
via the Internet

VISION, CONTINUED

I agree with Bill Howard's complaints about the hassles for people with less-than-perfect vision ("The Vision Thing," December 1), but he missed the biggest source of annoyance: magazine print. Most magazines (including ZD publications) seem to be using more and more low-contrast print (such as black type over a dark-blue illustration or white type in a light-brown table) and too small a font size in tables and illustrations. I know you pay your graphics staff big bucks to make your magazine presentable, but please show some mercy for those of us with less-than-perfect eyesight.

TOM GLIDDEN
via the Internet

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Netscape's Next Move

The new browser engine Gecko promises faster, slicker Web sites.

Netscape Communications hopes that Gecko—its compact, standards-based, open-source browser engine—will inspire a new wave of Web development in which people will build Web sites and applications once and view them anywhere, no matter the operating system or the device.

Like the lizard for which it's named, Gecko is designed to be small and fast. At less than 2MB, the engine is one-fifth the size of current browsers, promising a future in which browsers are much faster to download and much more practical to embed in hand-helds, pagers, and cell phones. At the same time, Netscape says that Gecko renders HTML dramatically faster than current versions of Navigator.

Communicator 5.0, the first

developers worldwide to extend, debug, and modify.

Netscape has abandoned its earlier strategy of promoting proprietary HTML extensions, and instead it's fervently latching onto open standards maintained by the World Wide Web Consortium. Microsoft is doing the same, though Netscape says its competitor sometimes violates the spirit of the standards process by rolling out new features while submitting wholly new proposals—effectively creating proprietary extensions and then foisting them on the standards committees.

Nevertheless, after years of divergence that frustrated Web developers—who had to build separate versions of their sites for both Internet Explorer and Navigator if they wanted to use features such as Dynamic HTML—the two major browsers are finally converging on a single shared set of standards.

Gecko promises

button that can accommodate HTML contents and depresses when it's clicked

CSS (Cascading Style Sheets) is used for formatting and positioning. Netscape says Gecko will support all of CSS1 and portions of the CSS2 specification relating to positioning. With one exception we found Gecko's implementation of CSS1 to be strong, including some sophisticated typographical features, such as the ability to specify distinct formatting for the first line of text in a paragraph or even for the first character (vastly simplifying the creation of drop caps). Oddly, the version of Gecko that we tested did not properly support CSS classes, a feature present even in 4.x browsers. Gecko supports relative and absolute positioning capabilities under CSS2.

A DOM (Document Object Model) is a standard that specifies a document's logical structure and enumerates the objects that scripts can access and manipulate to produce interactive effects (known as *Dynamic HTML*). Implementation of DHTML has been limited by incompatible DOMs in the Microsoft and Netscape browsers, so developers have had to write independent versions of their code for each browser. Adherence to a standard DOM should change that.

XML (Extensible Markup Language) is a method for describing data and its structure independent of formatting information. In the near term, Gecko will be built to use CSS for XML formatting, though Netscape says it expects to support XSL (Extensible Style Language) once that specification firms up.

RDF (Resource Description Framework) is a draft specification for representing metadata, or data about data—information supplemental to the actual contents of Web pages, such as their structure, ownership information, and cataloging data.

Gecko is to a browser what an engine is to a car: It's the part that does most of the work, but it's not a complete product by itself.

What Netscape is distributing on its DevEdge Web site and on the mozilla.org site is the layout engine, wrapped in an absolutely minimal user interface, which lacks even such basics as bookmarks.

Gecko's functionality is extremely rough, and we found, for example, that *PC Magazine's* home page rendered unintelligibly. Make no mistake: This is not a product you want to use except for experimental purposes.

—John Clyman and Don Willmott

end user product that will incorporate the Gecko engine, is due sometime in the first half of 1999. When it arrives, it will be the first major consumer software product to have been built on open-source development principles, which favor unveiling the innards of a program for

① Gecko supports floating in-line frames, which can be inserted within running text.

② Automatic insertion of drop caps and typographical effects for the first line of text in a paragraph are now possible.

③ Rendering and resizing of tables are quicker than in current versions of Navigator.

fields together; and BUTTON, an enhanced, three-dimensional version of a form-submit

support for a panoply of standards, including a number of new HTML 4.0 features—such as IFRAME, which creates floating frames within a page; FIELDSET, which groups multiple form

Java 2: World-Ready?

Sun Microsystems has just unveiled what is being called *Java 2*, which is actually the long-awaited Java Development Kit 1.2. Sun officials are calling it a "complete rewrite of the Java platform." Java developers have complained that Java applications aren't fast, that Java is a slow language to develop in, and that Java doesn't have adequate security. According to Sun's chief operating officer, Ed Zander, Java 2 addresses these concerns.

"Java
has now gone
mission-critical."
—Patricia Suetz,
general manager
of Java at IBM

Sun is positioning Java 2 for building mission-critical applications, as enterprises have historically balked at Java's approach to problems such as security. "We pounded the heck out of this thing in terms of stability and security," Zander says. Additions include faster runtime capabilities, better garbage collection, additional class libraries, and better security.

One of the criticisms of Java is that it has not resulted in as many applications as early backers predicted. A new licensing model and open policies for Java are intended to energize the world of Java applications development, ushering in clones of Java Virtual Machines.

The new model will let developers who agree to a license agreement at Sun's Web site download the source code freely. They'll be able to make changes to it without any intervention from Sun and also become Java licensees, able to license the source code to other developers.

The announcement of Java 2 drew reactions from many industry players. "Java has now gone mission-critical," said Patricia Suetz, general manager of Java at IBM. Suetz applauded the new licensing model for Java as well as the security enhancements. IBM expects to ship a number of new mission-critical Java-based applications this year.

This year should be pivotal in establishing whether Java can overcome the stigma of being inappropriate for enterprise applications. Says Sun's Zander, "Java is world-ready."—*Sebastian Rupley*



The Trouble with Jupiter



After months of anticipation, machines using Microsoft Windows CE Handheld PC Professional Edition (an operating system once code-named Jupiter) have found their way into the hands of customers—or at least into the arms of customers. After all, few of these systems are legitimate hand-helds. Most weigh over 2 and a half pounds and measure nearly 10 by 7 inches.

In testing a quartet of inaugural Jupiter machines for this issue's feature story, "State-of-the-Art Lightweight Portables," PC Magazine Labs encountered an operating system that was—despite doing everything it was billed to do—quite limited. Fundamentally, the HP Jornada, LG Electronics Phenom Express, Sharp Mobilon Pro, and Vadem Clio—aren't stand-alone units. Since they lack CD, floppy, and hard disks, you'll need access to a desktop PC to load applications or store any more than a minimal amount of data. Unless you're buying a Jupiter machine in lieu of a first PC, the \$900 to \$1,000 price tag seems high.

Likewise, Windows CE's office applications, Pocket Excel and Pocket Word, are designed as adjuncts to their desktop versions, letting you transfer a file from desktop to CE device, enter text, then transfer the file back to your desktop for formatting. And since such a device connects to your PC via its serial port, transferring files can take an inordinate amount of time. Be prepared to wait 10 minutes for a 1MB Excel file to be converted to Pocket Excel and transferred to your Jupiter unit.

And you may have problems opening transferred files. We had no difficulty with small, simple files, but a 700KB Excel file wrecked havoc. This two-sheet spreadsheet (the first sheet filled with formula entries) expanded to 1.2MB when converted to Pocket Excel and took several hours to open under CE.

If these devices aren't built for hearty

office work, then are they inexpensive "communication devices" as many companies bill them? They all offer built-in modems and come preloaded with Microsoft Outlook, but you're stranded if you use another e-mail client. You can also use them to surf to Web, but even the larger Jupiter screens are small (7.8- by 6-inches), and graphics load very slowly.

The systems also present limitations for making presentations on the road. Cramped and built with low-end LCD technology, the displays can't be adequately viewed by more than one person. The Jornada and the Phenom units offer VGA ports, letting you export a presentation to a desktop monitor, but the Clio and the Mobilon Pro units don't. Even if your device has a VGA port, your options are limited. Though you can easily convert PowerPoint files to Pocket PowerPoint, you can't

FAILURE TO EXCEL:
Most Jupiter units tested at PC Magazine Labs took several hours to open this complex 1.2MB Pocket Excel file.

edit any more than title pages under CE.

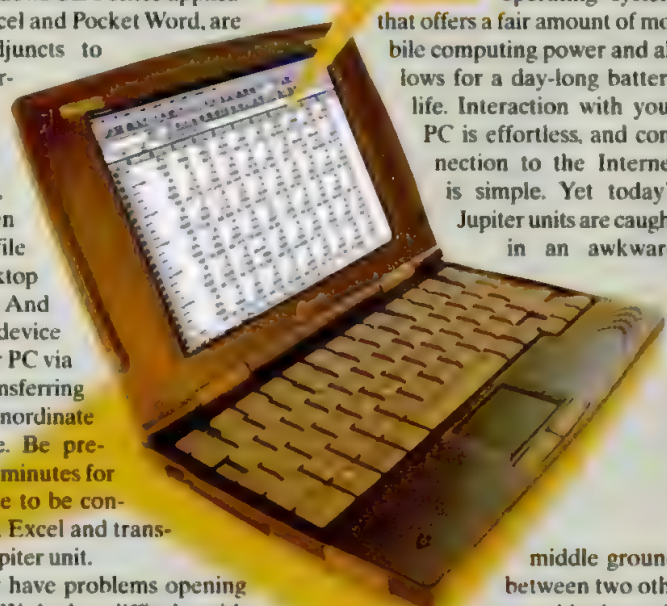
The latest version of Windows CE is a polished operating system

that offers a fair amount of mobile computing power and allows for a day-long battery life. Interaction with your PC is effortless, and connection to the Internet is simple. Yet today's Jupiter units are caught in an awkward

middle ground between two other portable classes. If you want a hand-held

personal information manager, a PalmPilot-class device is smaller and less expensive. Or if you want mobile computing, a value notebook today offers greater functionality yet costs little more than \$1,000.

—*Cade Metz*



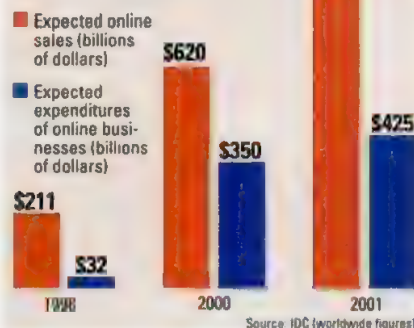
INTERNET

The Global Mall

America Online's recent deal to purchase Netscape and form a strategic alliance with Sun Microsystems has been widely interpreted as a power play in the world of e-commerce, and the development coincides with many other recent significant moves on the e-commerce front.

President Clinton recently held court on online commerce in Washington, and he announced a new e-commerce czar in his administration. In Washington, concern is focused on how to get more people buying online. "Many people who surf the Web don't shop there," said President Clinton in a recent speech outlining his e-commerce initiatives. Members of his administration are working with the Federal Trade Commission on protecting online consumers to the same extent as customers in retail stores.

E-Commerce: Ka-ching!



The White House wants to see more truthful advertising and stricter privacy protection online. It has named David Beier, a senior aide to vice president Al Gore, to succeed Ira Magaziner as head of the White

House's task force on e-commerce.

Clinton has been vocal about keeping the Internet free of taxation, and he has said his administration is currently working with other nations to develop global consumer-protection laws. John Chambers, CEO of Cisco Systems, predicts that by 2010 a quarter of all global commerce will be transacted over the Internet.

Several organizations have expressed concern that too few people are currently shopping online, however. A report from the Organization for Economic Cooperation and Development says that until better data appears on just how much e-commerce is actually taking place, it may take time before the global economy is truly affected by online commerce.

Still, the e-commerce numbers coming in are indicating rapid growth. Market research firm Jupiter Communications predicted that holiday online sales would total \$2.3 billion, up from \$1.1 billion last year.

—Sebastian Rupley

Conventional, Yes. Wisdom, No.

I'm fascinated by the introduction of the next generation of the PalmPilot, the Palm VII, which features wireless Internet connectivity. The technology is intriguing, but what's most interesting is how convincingly the product refutes the conventional wisdom about the future of the personal computer.

Conventional wisdom—propounded all but daily in newspaper and magazine articles around the country—is that people in large numbers will turn away from PCs and instead embrace inexpensive devices, especially for personal information management and for Internet access.

They ask: Why pay \$2,000 for a notebook computer when a \$400 PDA provides everything you need when traveling, plus longer battery life? Why buy a \$1,000 or even a \$700 full-featured desktop PC to access the Internet when a \$200 set-top box will get you on the Web more easily? And because Internet access is the leading reason people buy new PCs today, some pundits mistakenly conclude that WebTV devices and their ilk will overwhelm PC use in the coming years.

People who adopt this point of view point to the success of the PalmPilot. What people really want, they say, is an inexpensive device that does one thing well and is easy to use, which suggests that we'll soon walk around with our pockets full of separate but easy-to-use electronic devices.

What they fail to see is that the PalmPilot's success isn't due to its doing one thing well; the application itself is what has made the PalmPilot successful. If you could get the same functionality in an inexpensive but full-featured PC that was as small, as light, and as easy to use,

you'd want the greater flexibility and upgradability of a PC. Just ask the PalmPilot users who are adding keyboards and plugging in cell phones. Better yet, just ask the PalmPilot users who are unhappy that they'll have to throw out their current PalmPilots and spend \$800 to get the wireless Internet capability of the Palm VII.

Similarly, how many people buy WebTV terminals without adding a keyboard? Anyone who has Internet access wants e-mail as well. Then you discover you really need a printer, which you can add, or a force-feedback joystick, which you can't. Pretty soon it becomes clear that a PC would have been more sensible.

Despite conventional wisdom, Web terminals will be relegated to a small niche market as PCs continue to come down in price and as their makers build in more functions and easier Web access. And one bit of conventional wisdom that is absolutely irrefutable is that PCs will soon cost little more than Web terminals.

Under the heading "It pays to think these things through," I have to refer back to a recent column in which I poked gentle fun at the people who write press releases describing new computing products (December 15, 1998). My tongue-in-cheek version of their work referred to a fictitious product "Jargonware" from—I assumed—a fictitious company I dubbed Jargon Software Inc. Turns out there is indeed a company by that name. The company's execs exhibit a refreshingly light-hearted approach to naming their organization and their products, Jargon Writer and Jargon Reader. Fortunately, they also show a remarkable tolerance of columnist gaffes. But their approach to their software is all business, as you can see by visiting their Web site at www.jargonsoft.com.



Jake Kirchner

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What a laptop can do.

1. Get e-mail. 2. Send e-mail. 3. Search the Net. 4. Prepare memos. 5. Check appointments and contacts. 6. Set up a new derivative pricing model. 7. Put together a 3D animated short film. 8. Lay out the company newsletter. 9. Analyze data from radio telescopes. 10. Edit digital video. 11. Design a new kitchen. 12. Develop new software. 13. Develop new CD-ROMs. 14. Retouch swimsuit photos. 15. Play photo-realistic 3D video games. 16. Assist with scientific visualization. 17. Play back audio CD. 18. Expedite numerical analysis. 19. Do mail merges for the high school reunion (unless you went to a really small high school). 20. Aid in digital signal processor design. 21. Do database programming. 22. Use lots of floppy disks. 23. File income tax returns. 24. Composite digital video. 25. Author virtual reality. 26. Store a large number of files. 27. Connect to a large number of external storage devices. 28. Play educational CD-ROMs. 29. Conduct virtual reality demonstrations. 30. Balance the checkbook for a Fortune 500 company. 31. Run spreadsheets with decision-making and nested functions. 32. Analyze spreadsheet data by creating pivot tables. 33. Aid in artificial intelligence programming (implementing some version of the sigmoid model). 34. Create organizational flow charts. 35. Build animation for presentations. 36. Replicate and synchronize databases. 37. Do voice analysis. 38. Do audio editing. 39. Create a greeting card. 40. Use smart cards. 41. Help business people practice Japanese with a language CD-ROM. 42. Help ordinary people decipher a prescription using a CD-ROM. 43. Play video clips. 44. Create 250

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Introducing the Jornada 820 Handheld PC. • Just 2.6 pounds.

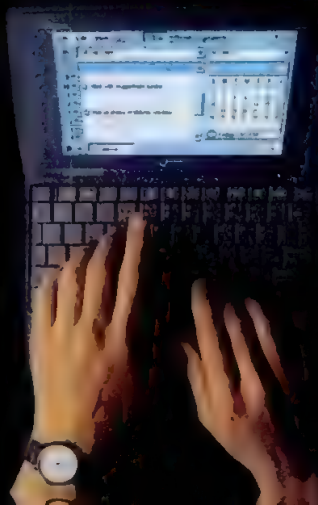
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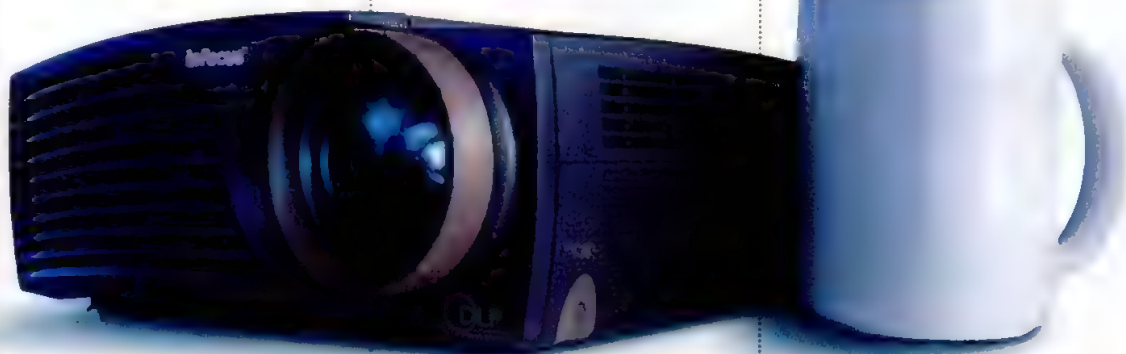


If a 6.8 pound projector can influence the entire computer industry, imagine what it can do for your meetings.

Why would PC Magazine rank a humble projector company among the likes of Intel, Microsoft, and the other most influential companies in the computer industry? Good question. They said

of projectors like our revolutionary new 6.8-pound personal series—the ones that earned In Focus an Editors' Choice Award and made us the only projector company on the list. Our personal projectors are so small and

projectors for conference rooms and fixed installations, too. So for projectors that are affordable, reliable, and just plain make you look great, there's really only one choice. The number-one



it's because In Focus is changing the way people use technology; more and more people are projecting from their laptop PCs, making the most of their meetings. They also said it's because

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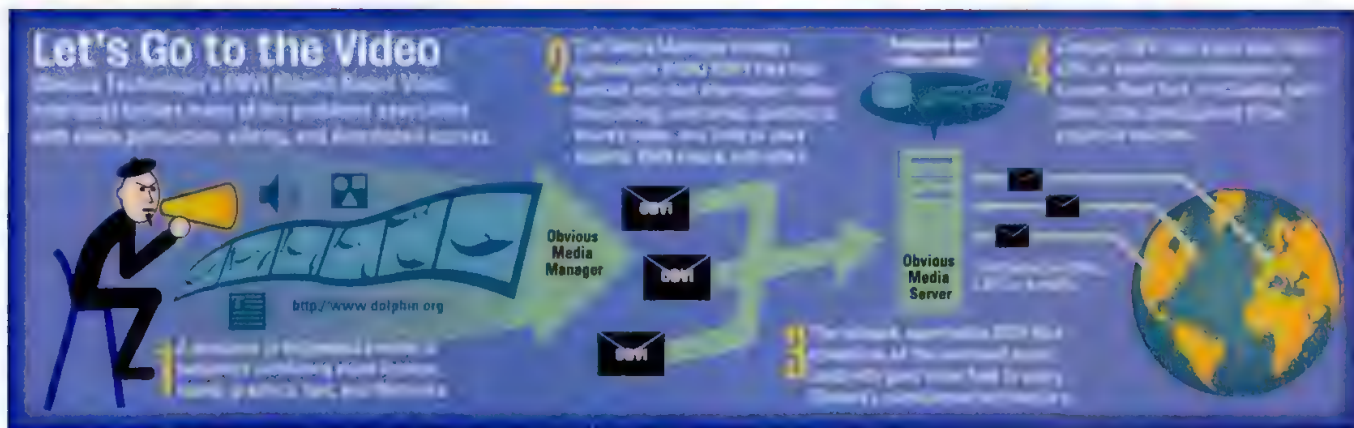
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MULTIMEDIA

Premiering Soon: A Web Video Studio

You don't have to be Disney or Lucasfilm to generate loads of visual assets. Car companies have thousands of hours of footage from crash tests, news organizations have vast video archives of world events, and ad agencies have miles of footage from commercials. And anyone who works with digital video knows that producing, editing, distributing, cataloging, and searching video footage over the Internet is a scary proposition.

Obvious Technology, a start-up based in San Francisco and Paris, has come up with a series of software tools with which it intends to remake the existing methods of video production—often involving huge amounts of wasted time and lots of emotional phone calls, faxes, and overnight-delivery charges to whisk video dailies to colleagues and clients around the world.

Streaming-video technologies, such as Microsoft NetShow and RealNetworks RealPlayer, solve the problem of distributing and viewing bandwidth-voracious video over the Web, but those are only parts of a much bigger puzzle. The Internet is basically useless in the actual production of, say, a 30-second, 10MB spot.

That's where Obvious Technology's compact file format OBVI (Object-Based Video Interface) comes into play. An OBVI file is only 100K, yet it contains all the elements required for collaboration. The actual video, sound, and graphics remain on the media server, while only pointers to the keyframes—as well as time-code information—travel in the OBVI file. During the creation of OBVI files, algorithms sense scene changes to create the keyframes and time codes—information critical in later editing and searching. Since the OBVI file is 100 to 1,000 times smaller than

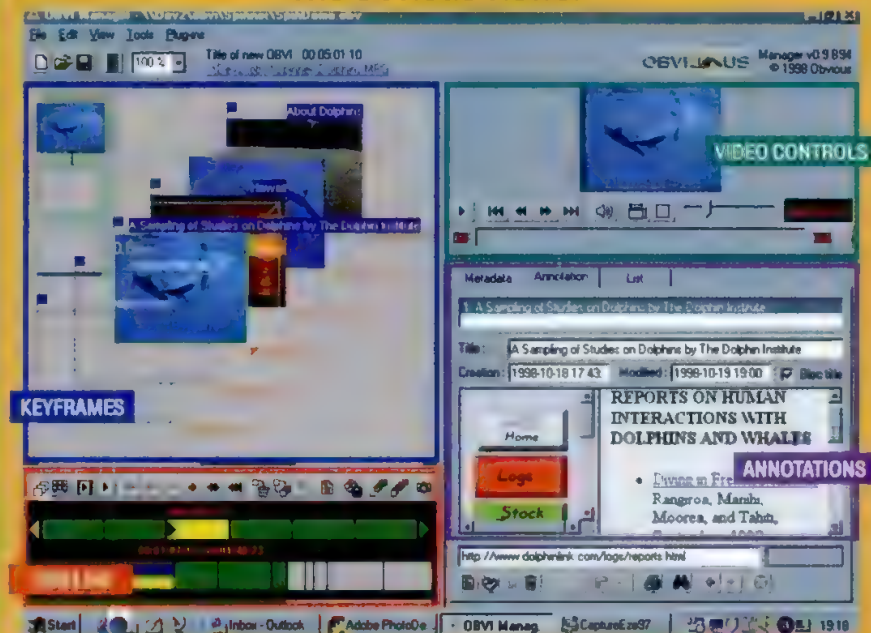
the actual video, it can travel efficiently over the Web and local area networks, as well as broadband satellite networks, says Howard Greenfield, senior vice president of product development and information technology at Obvious Technology.

By downloading the free screening viewer from the Obvious Technology Web site

(www.obvioustech.com), far-flung producers, colleagues, and clients can then collaborate over the Web—watch dailies, share comments, and edit video. (Since the video is digital, editing can be nonlinear.) The annotated file is then whisked over the Web back to the server, where the producer can collect all the changes and make the necessary edits to the original files on the server.

Obvious Technology plans to ship its software suite—the viewer, editor, manager, publisher, archive, and broadcast components—this spring. —Carol Levin

The Obvious Viewer



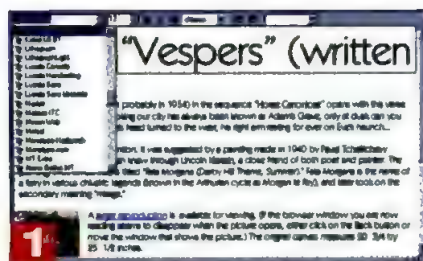
A free download from Obvious Technology's Web site, the Obvious Viewer lets far-flung collaborators screen full-motion video, record comments, add links to relevant Web pages, and edit time-coded keyframes. They can e-mail the edited OBVI files to each other and to the producer, who can

review changes and incorporate them on the server. While the source content remains on the media server, the compact OBVI file contains pointers to the content—text, sound, Web pages, images, and database tables. The architecture works over LANs, the Web, and broadband satellite.

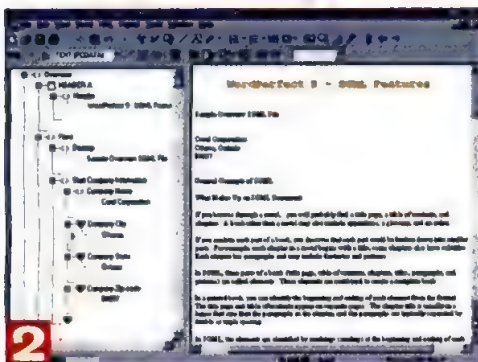
COREL WORDPERFECT OFFICE 2000

A Suite Preview

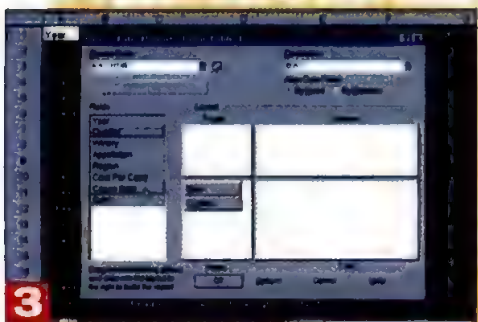
Corel WordPerfect Office 2000, due to ship in the second quarter of the year, is notable mostly for ease-of-use and speed improvements, although it also adds tightly integrated features such as eXtensible Markup Language (XML) support for Web publishing. More feature-packed than other office suites, including Microsoft Office, Corel's upcoming suite retains the file format of earlier versions, clarifies the menu structure, and transforms the PIM component Corel Central into an elegant and powerful program that stands out against the confusion of rival products.—Edward Mendelson



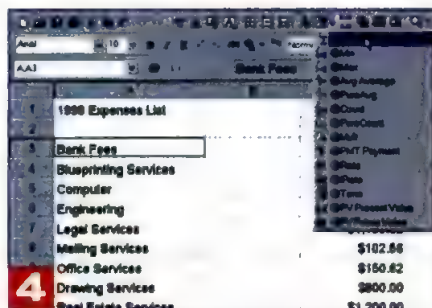
▼ The latest version of WordPerfect includes a powerful tool for building XML documents through a clearly laid out tree diagram.



▼ Quattro Pro's Dynamic Cross Tab Report corresponds to Excel's Pivot Tables, and it handles native Excel files smoothly.



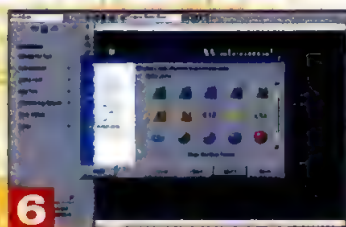
◀ WordPerfect and Quattro Pro both have a unique real-time preview, in which formatting changes are displayed instantly as you scroll through options.



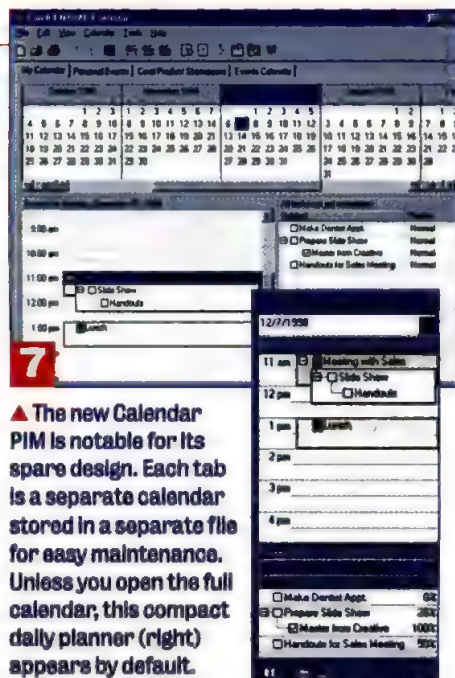
▲ Quattro Pro includes easy access to frequently used functions from a drop-down list in the toolbar. The Property Bar modifies the attributes of the current selection.



▲ The Presentations application retains the intuitive interface of earlier versions but adds a new Property Bar under the main toolbar for easy manipulation of objects currently visible.



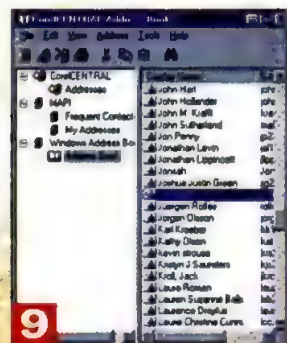
▲ Presentations now integrates an Internet Publisher, which converts a presentation into a Web-based slide show or Web site.



▲ The new Calendar PIM is notable for its spare design. Each tab is a separate calendar stored in a separate file for easy maintenance. Unless you open the full calendar, this compact daily planner (right) appears by default.



▲ The Paradox database, now more tightly integrated with the rest of the suite, includes easy-to-use wizards and experts. The query expert builds a query on one or more tables in a database.



▲ Corel's address book uniquely displays entries from all standard Microsoft Windows address books, including one used by Windows 95.

What's the fun of sampling just one when you can score all of them?

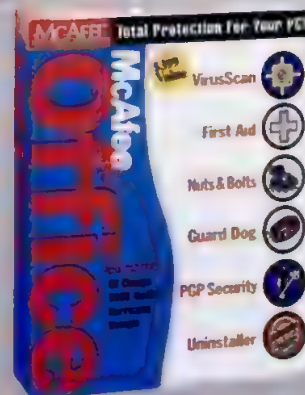


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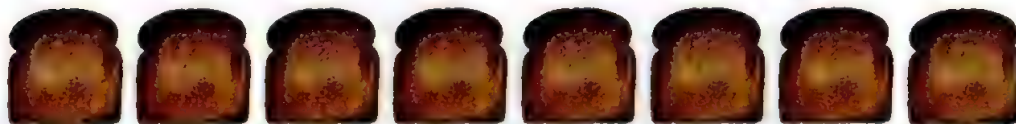
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Celeron Hits 400 MHz

We test sub-\$2,000 systems from Compaq, Dell, and Micron and have a look at AMD's new 400-MHz K6-2 processor.

By Carol Venezia

Yet another micro-processor from Intel has gotten a speed boost. This time, it's the Celeron, Intel's chip for what it calls "basic PCs" (translation: about \$1,200 or less, not including monitor). In January, new Celeron PCs running at both 366 and 400 MHz hit the market.

Like their slower brethren, the new Celeron CPUs have 128K of integrated L2 cache; this means that the cache runs at the same speed as the CPU core. So what this L2 lacks in size, it partly makes up for in speed.

Also like their predecessors, the new members of the Celeron family use a single-edge processor package (SEPP), which fits into a 242-contact Slot 1 connector. And although we didn't see any in this miniroundup, PC vendors can also purchase 366- and 400-MHz Celeron CPUs in ceramic pin-grid array (or PGA) packaging, à la yesterday's Pentiums (though like other Celerons, they utilize the P6 bus architecture).

You may hear the term *socket 370* used in conjunction with the PGA processors: That's because they plug into the motherboard via a 370-pin connection. This type of packaging is slightly cheaper to produce, so prices are a bit lower than those of the SEPP chips. In quantities of 1,000, Intel's pricing is \$143 each for the 366-MHz and \$183 for the 400-MHz socket 370 chips, compared with \$151 and \$191, respectively, for SEPP chips.

HOW MUCH FASTER?

If you're thinking that these new processors won't give you a huge performance boost over the 333-MHz Celeron (until now, the fastest Celeron available), you're right. On our ZD Business Winstone 99 tests, the 400-MHz Celerons posted scores that were 13 percent higher than 333-MHz Celerons, on the average. By comparison, the 400-MHz Celerons' scores were 20 percent lower than the 400-MHz Pentium II average from our December 1, 1998, roundup ("The Best PC"). You can expect the performance of Celeron/366 PCs to be about 6

percent better than that of Celeron/333 PCs.

But the interesting performance story comes when you compare the 400-MHz Celeron with AMD's new 400-MHz K6-2 processor with 3DNow! Technology. We saw a Compaq Presario 5190 Internet PC, the first system on the market with this flavor of K6-2 (see the sidebar "Compaq's Presario Brings Home the 400-MHz AMD K6-2"). Given that the 5190's graphics and disk subsystems were less capable than those of the Celerons we tested, we weren't surprised by its 19 percent-lower Winstone test score.

What did take us by surprise was the 5190's CPU score: 16 percent *higher* than the Celeron/400 average. We suspect that in this case, size does matter: The 400-MHz K6-2 has 512K of L2 cache—four times that of the Celeron. It doesn't run at full processor speed, however.

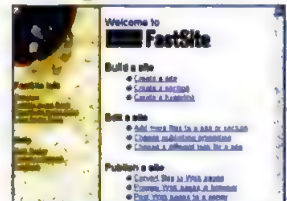
OUR ROUNDUP

For this first look at the 400-MHz Celeron, we gathered three machines: the Compaq Deskpro EP C400/6400/CDS, the Dell Dimension V400c, and the Micron Millennia C400. By the time you read this, Gateway will also have Celeron/400 PCs available, although the company was unable to provide a system in time for our testing.

We ran each machine through our complete suite of benchmark tests; performance was comparable on all counts, except on our ZD 3D WinMark

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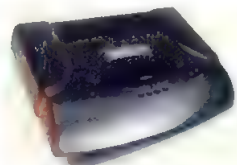
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STILL NEED THE NET?

The Ramp Networks WebRamp 310i may be your small business's best solution. *Page 75.*



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FIRST LOOKS

tests. Here, the Deskpro's STB Velocity 4400 graphics board contributed to a score that was 3.6 times as high as the Dimension's score and about double that of the Millennia.

Both the Dimension and Millennia use integrated graphics solutions that simply cannot handle as many complex 3-D functions in hardware as the Deskpro's nVidia RIVA TNT-based board can. But we found it made little difference in actual game play; all three machines were able to blow away the bad guys in Quake 2 with gusto.

So why buy a Celeron/400? Easy: You'll get a lot more stuff for less money than you could just a few months ago. Tough to argue with that logic.

Compaq Deskpro EP C400/6400/CDS

It's the 3-D performance champ of our Celeron roundup, but don't let that convince you that the Compaq Deskpro EP C400/6400/CDS can't be a flexible business PC as well. This machine is a great pick for corporations, because it's DMI-compliant and comes preloaded with a Wake on LAN-enabled Fast Ethernet adapter. On the downside, the Deskpro EP is the most expensive PC here (at \$1,780 street), provides less than half

the disk storage of its competitors, and opts for a CD-ROM drive rather than a slightly pricier DVD-ROM.

A hallmark of the Deskpro EP line is its "towerable" chassis. Because the unit's internal drive bays rotate, you can properly position them whether you choose a desktop or a tower configuration. And changing their orientation is easy: Just flip a couple of levers and reposition the drives inside the case—no screwdriver needed. As configured for our testing, the Deskpro EP had one front-accessible 5.25-inch bay and one internal 3.5-inch bay available for additional devices.

Perhaps because of its positioning as a business desktop, the Deskpro EP—unlike the Dimension and the Millennia—does not have a vendor-specific Internet setup wizard. It does have preloaded setup options for five popular online services, however, including AOL 4.0. And although you can get software packages such as Microsoft Office 97 Small Business Edition through Compaq's Small Business Solutions program (for an additional \$450), our test machine included only diagnostic software, Compaq's Insight Personal Edition and Intelligent Manageability Agent (for managing the machine on a

LAN), and Internet Explorer.

On the hardware side, the Deskpro EP features a 40X CD-ROM drive, 64MB of SDRAM (expandable to 256MB, as the system uses Intel's 440EX chip set for Celeron), and a comparatively small 6.4GB hard disk (6.2GB formatted). System audio is provided by a Compaq Premier Sound 16-bit ISA card and Compaq PS110 speakers. The speakers are more than adequate for day-to-day desktop use, although audiophiles can choose an Altec Lansing ACS48 system with a subwoofer for \$60 more.

On our benchmark tests, the Deskpro EP performed extremely well on ZD 3D WinMark 99, posting a score nearly double that of the Millennia. This high score was delivered by the system's STB Velocity 4400 AGP graphics accelerator with 16MB of memory. The Velocity board's 3-D capabilities simply outstrip those supported by the Dell and Micron systems' integrated graphics solutions. If you absolutely must have the best 3-D performance—and you're willing to pay for it—this is the



Compaq Deskpro EP C400/6400/CDS

Street price: With 6.4GB hard disk, 40X CD-ROM drive, Compaq 10/100 Intel NIC with WOL, Compaq \$700 monitor, \$1,780. Compaq Computer Corp., Houston; 800-345-1518, 281-370-0670; www.compaq.com.

PC for you. On our Business Winstone tests, the Deskpro garnered a score of 18.4, just a hair behind the top-scoring Millennia.

For companies that demand manageable PCs that comply with the requisite standards, the Compaq Deskpro EP C400/6400/CDS will fill the bill.

Dell Dimension V400c

In the small-business and home markets, Dell has made a lasting mark by consistently providing its customers with the most hardware for the least money, backed by great service and support. The Dimension V400c (\$1,699 direct) is no exception to the Dell rule, providing a big hard disk, a DVD drive, a great software bundle, and easy Internet access.

Getting online with this machine couldn't be easier, thanks to Dell's ConnectDirect, a joint venture with AT&T. Just click on the globe icon on the desktop and fill out one screenful of user information and you'll be sent directly to the Internet (after, of course, you plug a phone cord into the machine's V.90 PCI telephony modem and then plug it into the wall). No credit card is required. The first 30 days of service are free;

PERFORMANCE TESTS

400-MHz Celeron PCs



We tested these Celeron/400 PCs at 1,024-by-768 resolution, 32-bit color, and with DirectX 6 installed, on all measures except our 3D WinMark tests (run at 1,024-by-768, 16-bit color).

You'll notice that on the 3D WinMark

tests, the Deskpro scored significantly higher than the others. This is because the Deskpro's graphics board—an STB Velocity 4400 AGP card with 16MB of RAM—can handle more 3-D functions in hardware than its competitors' integrated graphics subsystems can.

High scores are best.

Bold type denotes first place.

denotes Editors' Choice.

	ZD Business Winstone 99	ZD 3D WinMark 99	ZD Business Graphics WinMark 99	ZD Business Disk WinMark 99
Compaq Deskpro EP C400/6400/CDS	18.4	451	146	2,535
Dell Dimension V400c	17.4	126	81	2,685
Micron Millennia C400	18.6	229	86	2,625
Average Celeron/333* (12/15/98)	16.0	N/A	70	2,410

* Based on "Great Home PCs," PC Magazine, December 15, 1998.

N/A—Not applicable. An average would not be meaningful because not all systems ran this test suite at the same resolution.

afterward, if you choose to stay with the ConnectDirect service, you'll be charged just \$19.95 per month for unlimited Internet access.

The Dimension also shines in the area of expandability. The machine's mini-tower case provides the most room for expansion of the three machines here, with three front-accessible bays open (one 5.25-inch and two 3.5-inch). This system ties the Deskpro for number of available slots, with one PCI, one shared, and one ISA slot in our test configuration. But the Dimension also wins the race for



Dell Dimension V400c

Direct price: With 12.9GB hard disk, 4.8X DVD-ROM drive, 3Com U.S. Robotics V.90 PCI Telephony WinModem, Dell 1000HS Trinitron monitor, \$1,699.
Dell Computer Corp., Round Rock, TX; 800-999-3355, 512-338-4400; www.dell.com;
414 at www.pcmag.com/info/link.

memory expandability: Because this PC uses Intel's 440BX chip set, it can accommodate up to 384MB of SDRAM via three DIMM sockets. As configured, the Dimension had one free IRQ.

You won't find this machine lacking in hardware, either. Our test system was configured with a 12.9GB (12.4GB formatted) 5,400-rpm hard disk; a 4.8X DVD-ROM drive with software decoding; and an exceptional 17-inch Trinitron monitor. We were quite impressed with the quality of DVD movie playback on this machine—a high-action film played smoothly, with no jerkiness and no jagged edges, even while it was showing fast-moving, wide-angle scenes. Audio is provided by an integrated Yamaha PCI chip set, augmented by an acceptable set of harman/kardon HK-195 speakers.

The Dimension posted the

Editors' Choice

• Micron Millennia C400



PC buyers are getting more discriminating than ever before.

And who can blame them? If you can get the same basic hardware components from just about everyone, you're going to shop around. And you're going to buy from the vendor that adds the most value to the hardware.

Our Editors' Choice in this 400-MHz Celeron roundup, the Micron Millennia C400 (\$1,519 direct), shows just how much you can add to a PC with a bit of creative thinking. A unique feature offered with the machine is a one-year scholarship to Micron University, which lets you take instructor-led or self-paced courses online on computing-related topics. Add a V.90 PCI modem, Micron's new Easy Internet (a setup wizard that will have you surfing like a pro in minutes), and 30 days of free unlimited Internet access and you have one well-connected machine.

You'll also be impressed with just how much hardware you can get with the Millennia, which is the lowest-priced system here. If you're looking for a PC that provides the tools you'll need to keep pace in an ever-changing, computing-centric world, the Micron Millennia C400 is the system for you.

top score on our ZD Business Disk WinMark 99 tests. It placed last on both our Winstone and 3D WinMark tests, though: On the former tests, its score was only about 6 percent behind, but on the latter measure, its score was leagues behind the Compaq and Micron units.

The Dimension's integrated ATI Rage Pro Turbo AGP graphics chip set with 8MB of memory simply could not keep up with the other vendors' solutions on certain 3-D calls, which significantly affected its 3D WinMark score. In spite of its low score, we didn't experience any major problems while playing games on the machine.

Dell completes the Dimension's package with Microsoft Office 97 Small Business Edition, plus a three-year warranty. The company also earned a grade of A on our most recent Service and Reliability Survey. This Dimension line is all about value, and the Dimension V400c delivers it in spades.

Micron Millennia C400



In an increasingly beige PC world, customers are looking for much more from a computer vendor than just a box full of hardware.

They want a company that will also provide services and software that will significantly enhance and ease the computing experience. And that's what you'll get with our Editors' Choice in this mini-roundup, the Micron Millennia C400 (\$1,519 direct).

This system's "beyond the box" experience starts with Micron Easy Internet, a joint venture with AT&T that provides Millennia customers with 30 free days of unlimited Internet access, no credit card required. Just click on the labeled icon on the desktop and fill out one screen's worth of information and you'll be surfing in minutes.

But Micron takes the online experience one step further with

SUMMARY OF FEATURES

400-MHz Celeron PCs

	Compaq Deskpro EP C400/6400/CDS	Dell Dimension V400c	Micron Millennia C400
Price (including 17" monitor)	\$1,780 street	\$1,699 direct	\$1,519 direct
Hard disk capacity	6.4GB	12.9GB	13GB
Graphics adapter/memory	STB Velocity 4400 AGP/16MB	Integrated ATI Rage Pro Turbo AGP/8MB	Integrated nVidia RIVA 128ZX/8MB
Monitor	Compaq S700	Dell 1000HS Trinitron	Micron 700Vx
CD-ROM or DVD-ROM drive	40X CD-ROM	4.8X DVD with software decoding	4.8X DVD with software decoding
Sound	Compaq Premier Sound (ISA)	Integrated Yamaha 64-voice wavetable (PCI)	Integrated ESS 64-voice wavetable (PCI)
Speakers	Compaq PS110	harman/kardon HK-195	Advent 009
Modem or network adapter	Compaq 10/100 Intel NIC with WOL	3Com U.S. Robotics V.90 PCI Telephony WinModem	3Com U.S. Robotics PCI 56K WinModem

FIRST LOOKS

Micron University, a joint venture with Microsoft, Micron, and Ziff-Davis (ZDU). With the Millennium, you get a one-year "scholarship" to MicronU, during which you can take as many online courses as you desire. There are over 100 courses (both self-paced tutorials and instructor-led classes), with topics ranging from database programming and networking Web servers to DHTML and Photo-shop design.

On the hardware side, you'll find a 13GB hard disk (12.4GB formatted), a 4.8X DVD-ROM drive with software decoding, and a 3Com U.S. Robotics 56K PCI WinModem. For DVD decoding, the system uses InterVideo's WinDVD, Version 1.0. The soft-

ware interface doesn't provide as many control-button options as Dell's setup, but playback was just as impressive. Sound is provided by an integrated ESS PCI chip set, which is augmented externally by a set of Advent 009 speakers with subwoofer.

Because the PC's micro-tower case is smaller than the average mini-tower, you will give up a bit of expandability compared with the other systems in this roundup. As tested, our Millennium had one empty 5.25-inch front-accessible drive bay, one free PCI and one ISA slot, and one open DIMM socket out of two.

The Millennium performed well on our benchmark tests, posting the roundup's highest Winstone score by a very slight margin over

Micron Millennium C400

Direct price: With 13GB hard disk, 4.8X DVD-ROM drive, 3Com U.S. Robotics 56K PCI WinModem, Micron 700Vx monitor, \$1,519; Micron Electronics, Nampa, ID; 888-634-8799, 208-893-3343;

www.micronpc.com
415 at www.pcmag.com/infoclink



the Deskpro. With its integrated nVidia RIVA 128ZX graphics chip set with 8MB of memory, the machine posted a 3D WinMark result that lagged the Deskpro by half but was 103 points higher than the Dimension. As with the Dimension, certain advanced 3-D functions that are supported in hardware by the Deskpro's STB Velocity board are not supported by the Millen-

nia's 128ZX accelerator.

Micron also bundles useful software, including Microsoft Office 97 Small Business Edition with Streets 98 and Norton AntiVirus. If you're looking for a computing experience—not just a computer—the Micron Millennium C400 is a great choice. **PC**

Compaq's Presario Brings Home the 400-MHz AMD K6-2

The AMD K6-2 processor with 3DNow! technology has proven a stiff challenger to Intel's wares. Vendors including Compaq, Hewlett-Packard, and IBM have all adopted the K6-2 into their home PCs because, in many cases, it allows them to get a big megahertz number on the box for a low price. Compaq continues this trend by bringing the first 400-MHz K6-2-based PC to market, the Compaq Presario 5190 Internet PC.

Like other members of the Presario family, the 5190 comes well equipped with a great variety of hardware and software to please the entire family. The system, priced at \$1,500 (street) after a \$100 rebate (details below), includes 128MB of RAM, a 12GB hard disk, a third-generation DVD-ROM drive, a built-in Iomega Zip Drive, a 56K V.90 modem, and a 17-inch Compaq MV700 monitor.

The 5190 is housed in a micro-tower case, featuring the Creativity Action Center—two USB ports and a game port mounted up front behind a flip-up door. This way, you can connect and swap out peripherals such as joysticks and USB cameras easily and quickly. The major drawback of micro-towers, however, is in their limited expandability options. As configured, the 5190 has no free drive bays, though a shared expansion slot is free.

What the 5190 may lack in expandability is more than made up for by its connectivity options. First, there's an integrated 10-Mbps Ethernet port, so if you choose to purchase cable modem service or want to add the 5190 to a home network, your machine will be ready to go. You can also hook up your choice of Compaq monitor—either LCD panel or traditional CRT—without having to worry about the graphics board. Augmenting the 5190's integrated ATI Rage LT



Pro 2X AGP graphics chip set with 4MB of video RAM are both standard VGA-out and digital flat-panel connectors.

The crown jewel of the 5190's connectivity options is Compaq's Easy Internet Access Plan. The purchase of a 5190 entitles you to 50 free hours of Internet access through GTE. You must provide a credit card number and use your 50 hours within 30 days of signing up, but once you do sign up, you get a \$100 rebate. If you choose to stick with the GTE service, unlimited Internet access costs just \$19.95 per month (\$18.95 for GTE long-distance customers). And getting online couldn't be easier: Just double-click

on the "Set Up Internet Here" icon on the desktop, answer a few questions, and you'll be surfing in under 10 minutes. And the included Compaq Easy Access Internet Keyboard does exactly what the name claims: Just hit the button with the "I" on it and you're off to the Web.

On our benchmark tests, the 5190 performed acceptably but not as well as the 400-MHz Celeron PCs. Its Winstone score of 14.7 was about 19 percent lower than the Celeron average; also, the unit was unable to complete our 3D WinMark tests.

The 5190 comes with a package of software that includes Microsoft Works, Encarta, Money, and Bookshelf; Quicken 98 Basic Edition; and a 3DNow!-aware game, Rage's Incoming, among others. If you don't mind that it's not a barn-burner in terms of performance, the Compaq Presario 5190 Internet PC is an impressive, flexible choice for families or individuals looking for an affordable PC.—CV
Compaq Presario 5190 Internet PC. Street price: With 400-MHz AMD K6-2 CPU, 128MB RAM, 12GB hard disk, DVD-ROM drive, Iomega Zip Drive, 56K V.90 modem, Compaq MV700 17-inch CRT monitor, \$1,500 (after \$100 rebate). Compaq Computer Corp., Houston; 800-345-1518; www.compaq.com.



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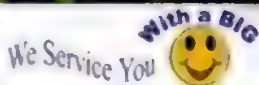
- 400 MHz processor available with 512K or 1 Meg L2 cache

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SIZE ISN'T EVERYTHING.



(just ask goliath)

**We're not
the biggest,
so we have to
be the best.**

So, we're not the biggest - that means we're smaller. We have to be the best. By offering the perfect combination of service, quality and price, you get the best hardware solution possible. **Personalized Service:** You will be assigned a SAG Integration Specialist who will be your single point of contact from pre- to post-sale. Their job is to know your system inside and out. **100% True Customization:** Everybody wants to like our limited offerings, but our systems are truly built to order, yours. **Warranty & Support:** Our 2-year warranty means we're confident in our quality - that you'll speak directly to our own on-call tech support. **Leading Edge Technology:** We are known for being first to market with the latest technology. **Best Prices:** Our prices are consistently lower than competitors, not for yourself, or gogalead.com. **Top Quality:** We only use top of-the-line components - that's why we have so many clients. Here are just a few:



SAMPLE WORKSTATIONS

SIX DUAL RAID 0-5 XEON WORKSTATION

- 1 Intel Pentium II Xeon 450MHz Processor
- 512KB Cache, Expandable to 2 CPUs
- 256MB SDRAM Expandable to 2GB
- Slots: (6) PCI, (1) ISA, (1) AGP
- Creative Labs 128 PCI Sound
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4613

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842

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3930

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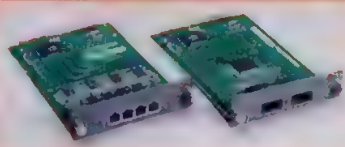
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Shoot Like the Pros

Two new digital cameras bridge the gap between professional and amateur digital photography.

By Daniel Grotta and
Sally Wiener Grotta

Prosumer digital cameras bridge the gap between sub-\$1,000 consumer cameras and \$10,000 to \$28,000 professional models. Designed for heavy-duty use and abuse, these cameras are, for the most part, larger, better-built, and more robust than entry-level cameras. They also typically provide greater picture-taking versatility and higher image quality.

Most prosumer models lack one or more standard professional features, such as fully interchangeable lenses, manual focusing, spot/matrix metering, auto-bracketing, easily accessible f-stop and shutter-speed adjustments, or optical through-the-lens viewing. And generally, though image quality is better than that of entry-level cameras, it isn't up to the level of professional digital cameras.

Prosumer cameras are targeted at business users, advanced amateurs, or professional photographers who want the option of choosing either point-and-shoot simplicity or professional-style manual control, and whose intended print output is no larger than 8 by 10 inches.

We tested the \$1,200 (street) Canon PowerShot Pro 70 and the \$2,000 (street) Fujifilm DS-330 Digital Camera, very different cameras, not only in appearance and operation, but also in intended market. Despite its name, the Canon PowerShot Pro 70 will appeal mainly to nonprofessional photographers who don't want to bother with f-stops and shutter speeds, setting white points, or selecting ISO sensitivity. The DS-330 has the look and feel of a medium-format range-finder film camera, so professionals will feel right at home with it.

Each camera comes with a rechargeable nickel hydride battery, high-speed 3X optical zoom lens, burst-mode and macro capability, optical viewfinder, and removable memory card. Both can save images as proprietary, uncompressed TIFF files in addition to high and standard resolutions and different JPEG compression levels. With a 0.5-inch, 1.68-million-pixel CCD, PowerShot images expand to a 4.5MB file. The DS-330's 0.8-inch, 1.4-megapixel CCD produces a 3.7MB TIFF file.

Not surprising, the PowerShot's higher density data translates into better image depth and detail. On the

BIG SHOT: The Canon PowerShot Pro 70's images are sharp, crisp and detailed, but clip very slightly in the shadows and highlights.



other hand, the DS-330 captures a greater range of shadow and highlights and its colors are more accurate. But these two cameras are so comparable that the decision becomes a matter of personal preference and budget, with the PowerShot's reasonable price giving it a decided advantage.

CANON POWERSHOT PRO 70

The PowerShot Pro 70's oversized, asymmetrically placed, thick lens snout gives the camera a 35-mm single-lens-reflex-like appearance, but its main viewfinder is optical and not through-the-lens viewing. Don't rely on the optical viewfinder for accurate framing, because it shows only 84 percent of what the CCD actually captures. The viewfinder is, however, protected from extraneous light by a rubberized cup, and has a focusing diopter for users who wear glasses.

The PowerShot has a built-in 2-inch LCD, which can swing out and rotate up to 270 degrees, for macro, preview, and playback. This makes it easy to

(1/2 to 1/500 of a second in high-resolution mode), but manually setting the f-stop and pressing the shutter button halfway will display the current shutter speed—change the f-stop, and the shutter speed will change correspondingly.

Controls are generally well marked and easy to use. The icon for Small (756-by-512) resolution mode, however, is virtually identical to the Large (1,536-by-1,024) resolution mode icon, so you can easily mistake one for the other.

A wheel knob on the side of the lens snout turns the camera on and selects the capture, play, and PC connect modes. Some modes and functions can be set via the control panel on top of the camera while others require paging through a menu on the LCD. Users can shoot everything on auto or can manually set exposure compensation, f-stops (for controlling depth of field), and continuous mode (burst rate).

One feature that is unique to the PowerShot is its ability to accommodate two CompactFlash memory cards.

Though the second card may be marginally useful, the new, higher-capacity cards (up to 96MB now; 160MB later this year) make it somewhat redundant. Also, the camera doesn't automatically switch to the second card when one fills up.

Like professional cameras, the PowerShot uses an external, not a built-in, flash. The external flash can be bounced or positioned farther away from the lens, giving you greater lighting control, as well as eliminating shadows and red-eye.

When an optional Canon 220EX (\$130) or 380EX (\$170) Speedlite is attached to the PowerShot's hot shoe, the

angle the LCD for viewing in the brightest light and even allows subjects in front of the lens to see themselves. Unlike most other digital cameras, the PowerShot doesn't automatically turn the LCD on when you select macro mode.

The lens zoom is ideal: slow, smooth, and quiet. The PowerShot doesn't allow manual focus or auto-focus control, but it does have a focus lock that lets users keep the focus on an off-center subject. There's no specific control for setting shutter speeds



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strobe's lens will focus to match the coverage of the camera's auto-focus lens. Unfortunately, even with a battery booster pack on the strobe, the flash cannot be activated when the PowerShot's burst mode—which allows users to capture up to 20 images in the Small mode—is selected.

For all its advances and advantages, shooting with the PowerShot is almost as sluggish as it is with many consumer cameras. There's a delay of almost one second between shutter depression and image capture. Processing and saving Large images takes 4 to 7 seconds, depending on the state of the battery. On the other hand, the nickel hydride battery recharges in only 70 minutes.

The PowerShot Pro 70's images are sharp, crisp, and detailed. Colors tend to be slightly cold (blue) but are nonetheless pleasing. Exposure is accurate with incidental light or strobe light. The driver is part of the Twain interface, so we had no problems opening Canon's proprietary raw TIFF file. All in all, the PowerShot Pro 70 delivers semiprofessional performance at just about amateur prices. **Canon PowerShot Pro 70.** Street price: \$1,200. Canon Computer Systems Inc., Costa Mesa, CA; 800-652-2666; www.ccsi.canon.com; 416 at www.pcmag.com/infolink.

FUJIFILM DS-330 DIGITAL CAMERA

The Fujifilm DS-330 Digital Camera is actually a third-generation product; it's the successor to the Fujifilm DS-300, which used the same CCD and other components of the \$12,000 to \$15,000 Fujifilm DS-505 and Fujifilm DS-515 professional digital cameras. The DS-330's CCD was tweaked for even higher image quality, and the price is \$500

lower than its predecessor's.

The DS-330 has the largest CCD in its class, which means that the 1.4 million uninterpolated square pixels are larger and more light sensitive. Users can easily change the ISO equivalency from 100 to 400 for low-light situations, without paying the usual penalty of increased noise.



Although its top resolution is a modest 1,280-by-1,024, excellent color fidelity, color anti-aliasing, and extended dynamic range combined with a razor-sharp nine-element auto-focus power-zoom lens boost image quality well beyond that of many cameras with higher resolutions. The camera even has an unsharpen function algorithm built in; its use is not recommended for photos of people or landscapes.

For best image quality, pictures can be saved as raw, uncompressed TIFF files. Fuji's TIFF format is proprietary, however, requiring the user to install an Adobe Photoshop plug-in to open. We found that Micrografx's Picture Publisher supports Fuji's TIFF without the plug-in.

The DS-330 may be operated as a point-and-shoot camera, a semiautomatic (aperture or shutter priority mode), or a fully

manual device. There's also a program mode, in which everything but the focus is set automatically. The DS-330's auto-focus mechanism employs both *active* (infrared) and *passive* (phase detection) system sensors for pinpoint accuracy.

Manual focus, however, may



IN THE DETAILS: The Fujifilm DS-330 Digital Camera captures accurate colors and a lot of detail in the highlights and shadows.

confound some users because there's no focusing ring on the lens or split-image optical viewfinder for accurately assessing distances. Instead, users must hold in the MF button on the back of the camera and rotate a button on top of the camera to select the desired distance (which is displayed in meters, not feet).

There's no built-in LCD viewfinder, but Fuji offers a \$250 camcorder-type external LCD viewfinder that slips into the accessory shoe on top of the camera. The viewfinder has a focusing diopter for use without eyeglasses, is highly visible even in bright light, and can swivel up to 90 degrees for oblique or even waist-level viewing.

Switching between automatic, semiautomatic, and manual modes; high resolution (1,280-by-1,024) or standard resolution (640-by-480); selecting compression levels, setting auto or manual white-balance, ISO equivalency, or activating half-stop or full-stop bracketing is

fast and easy. You can also toggle between color and black-and-white mode, or activate the 2X digital zoom.

The DS-330 saves to a Type I or Type II PC Card or, with an adapter (not included), either CompactFlash or SmartMedia cards. Fuji issues dire warnings about using any memory other than its own brand, but we had no difficulty saving to Lexar and SanDisk CompactFlash cards.

Unlike the PowerShot, the DS-330 has a built-in electronic flash, which automatically focuses in sync with the auto-focus lens for accurate coverage. It also has a hot shoe for installing an external flash, or Fuji's optional slave unit, for working with studio strobes.

The DS-330 is almost as fast as a film camera. Its controls are intuitive and well placed, and many of its parameters can be changed quickly without going into the setup mode. There's virtually no delay between pressing the shutter and capturing an image, and the recycle time before the camera is ready to shoot again is just over a second.

For action or sports photography, Fuji offers an optional \$500 Extension Unit that attaches to the camera's base and increases the burst-mode rate to 4.5 frames per second for a total of 12 frames. The Extension Unit also has a built-in SCSI interface for faster data transfers.

The one jarring note in an otherwise excellent system is cost. By the time buyers add a memory card, LCD viewfinder, and Extension Unit—which we feel should be part of the system and not options—the price jumps even higher.

Fujifilm DS-330 Digital Camera. Street price: \$2,000. Fuji Photo Film USA Inc., Elmsford, NY; 800-378-3854, www.fujifilm.com. 417 at www.pcmag.com/infolink.

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Account Ability

M.Y.O.B. adds usability, customizability, and accounting muscle to its laudable tools.

By Kathy Yakal

The first Windows-based small-business accounting program to hit the market, M.Y.O.B. has always been one of the best. This upgrade boasts many small changes and a few big ones—the most notable being a professional time-billing function. Best!Ware targets inventory-based businesses of up to 25 employees and \$2.5 million in sales, but M.Y.O.B. Accounting Plus 8.0 (\$180 street) is also a good fit for service-based businesses.

The program provides tools

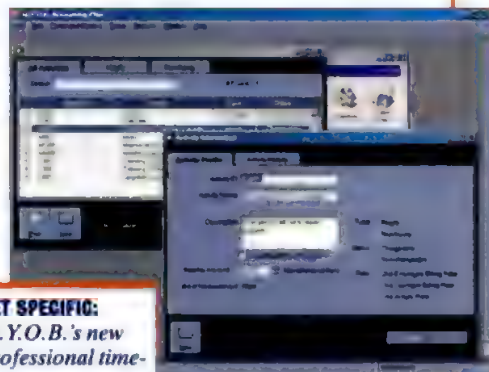
to help you manage accounts, process purchases and sales, track inventory and service-related products, keep payroll checks and tax payments rolling, and generate necessary and useful reports. OfficeLink, a feature introduced in the previous version, exports M.Y.O.B. data into Corel WordPerfect and Microsoft Word and Excel to generate spreadsheets, enhanced reports, charts and graphs, and personalized mailings.

An impressive level of detail is evident in features like M.Y.O.B.'s contact logs (a history

of interaction with employees, customers, and vendors) and in the deep drill-down available in all areas of the program. A serious deficit, though, is a dearth of support for online banking and bill paying.

The new interface houses an effective navigational system that lets users deliver or grab the information they need quickly. You can use the graphical flow chart or menus to move from task to task. Buttons on the main screen take you to a categorized to-do list, a focused search

GET SPECIFIC:
M.Y.O.B.'s new professional time-billing feature lets you define activities in detail.



tool, M.Y.O.B.'s numerous customizable reports, and the M.Y.O.B. Analyst (commonly used financial reports).

Another new feature lets you record and track your time-billing records in thorough, flexible ways. You can, for example, bill chargeable work not yet billed; track nonbillable time; price by client, activity, or employee; and bill by units as well as hours. Other new features include real-time updating and specifying individual preferences in network use, user-defined aging for sales and purchases, the ability to save multiple custom-designed forms, and automatic saving of entries, as well as a data optimization Wizard.

Every small business has a unique set of accounting needs, but M.Y.O.B. joins its closest competitors—Peachtree Complete Accounting and QuickBooks Pro—in providing the core tools required, with varying degrees of usability and customizability. The Peachtree program is still the most robust of the bunch, but M.Y.O.B. is not far behind. If you don't need support for online banking and bill paying, you should put M.Y.O.B. Accounting Plus 8.0 on your short list of candidates. **M.Y.O.B. Accounting Plus 8.0.** Street price: \$180. Requires: 16MB RAM, 40MB hard disk space, Microsoft Windows 95, 98, or NT 4.0. Best!Ware Inc., Rockaway, NJ; 800-322-6962, 973-586-2200; www.bestware.com; 413 at www.pcmag.com/infolink.

Speedy Web Site Creation

Lotus's FastSite 2.0, simple yet limited, converts existing documents into bare-bones Web sites.

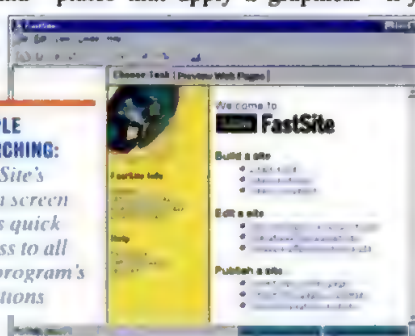
By Edward Mendelson

With FastSite 2.0, from Lotus Development Corp., you can convert word processing, spreadsheet, presentation, and other files into no-frills Web sites and upload them to your server. This package (\$99 list)—based on a version included in Lotus SmartSuite Millennium Edition—offers little flexibility and no automation features to detect and upload modified files. But if you want to post existing files to the Web with a minimum of effort and don't care about the elegance of the output, FastSite gets the job done fast.

When a site created by FastSite appears in a browser, it displays a bare-bones navigation frame at the top, with unlabeled buttons leading forward, back, or up in the site and the home pages and converted pages in a larger frame below. Hyperlinks appear only on the home page and on optional home pages for

subsections of the site; the imported pages have no links or other navigation tools.

You create a site by selecting one of 34 customizable templates that apply a graphical



style to the front page and navigation bars built by the program. Files from any standard format can be dragged into the program to be converted into Web pages, which you preview in FastSite or your default browser.

With files created by Microsoft Office or SmartSuite, FastSite doesn't convert the pages itself but invisibly opens the program that created the file and uses it to output HTML code. With other standard file formats—or with

Office and SmartSuite formats, when you don't have a copy of those suites on your system—FastSite uses HTML conversion filters from Verity Corp.

You can replace FastSite's default graphical backgrounds and navigation buttons using a confusing set of dialog boxes that offer no Undo function. Worse, if you use the feature that lets you further modify the program's home pages using a separate HTML editor, FastSite's built-in page modification features are no longer available for those pages; to get them back, you have to delete the page and start over. Deleting a section home page also removes all the data pages in that section.

If you want the undisputed leader in this product category, consider InfoAccess's \$495 (list) HTML Transit 3.0. FastSite costs a lot less—but it also does a lot less.

Lotus FastSite 2.0. List price: \$99. Requires: 24 MB RAM, 12 MB hard disk space, Microsoft Windows 95, 98, or NT. Lotus Development Corp., Cambridge, MA; 800-343-5414; www.lotus.com/fastsite; 411 at www.pcmag.com/infolink.



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ViewSonic VP1100
July 1998



ViewSonic PT815
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www.viewsonic.com

Easy, Accurate Drawing

AutoSketch Release 6 is the latest step in the evolution of a superb drawing program.

By Stephen W. Plain

Though it's full of sophisticated features that let you produce highly precise and diverse drawings, AutoSketch Release 6 (\$99 direct), from Autodesk, offers an ease of use that makes it suitable for many. This version includes 3-D features, several wise enhancements to drawing tools, and improved import functionality.

The truly flexible program lets you create all types of drawings, from floor plans to detailed part assemblies, with customizable toolbars, a substantial symbol library, and powerful grid, coordinate, and measurement features. New "snap" modes—designed to help you place points exactly where you want them—take a

little time to learn, but they make the drawing process quick and accurate. Since different types of drawings require different program configurations, AutoSketch includes a group of Application Wizards that step you through the process of setting appropriate options and symbol sets.

One of the most substantial new features is a group of 3-D capabilities, including extrusion and transformation features. We produced both parallel and perspective-adjusted extrusions from basic 2-D entities by simply selecting them, picking the appropriate tool from the 3D Effects toolbar, and stretching the shape. Three other buttons on this toolbar let you quickly transform objects from the left, top, and right to place

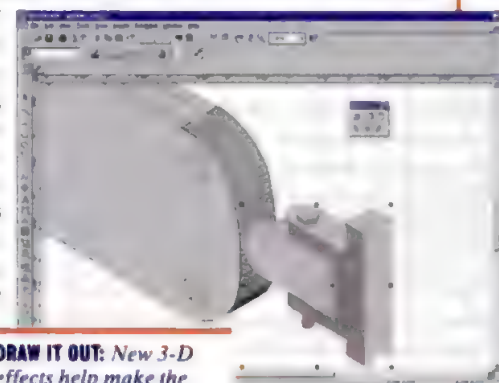
them into isometric planes.

Another enhancement is real-time zoom and pan. You can continuously zoom in and out of a drawing by dragging the mouse cursor up and down the screen. Similarly, you can drag the drawing in any direction to pan around. We turned to this powerful feature often during testing.

A new detail-view feature lets you speedily zoom in to a portion of a drawing and then use that section as a detail view at any scale, anywhere in the drawing. AutoSketch Release 6 imports AutoCAD DWG drawing files and converts individual entities automatically.

The new additions to the program are not earth-shattering, but they do improve productivi-

ty; the company offers a \$59 upgrade to existing users. Whether you turn to it occasionally or daily, you'll find AutoSketch



DRAW IT OUT: New 3-D effects help make the already impressive AutoSketch Release 6 even more productive.

Release 6 a great application.

AutoSketch Release

6. Direct price: \$99. Requires: 16MB RAM, 41MB hard disk space, CD-ROM drive, Windows 95, 98, or NT. Autodesk Inc., San Rafael, CA; 800-228-3601, 415-507-5000; www.autodesk.com; 410 at www.pcmag.com/infolink.

Real Improvements

The final release of G2 products from RealNetworks redefines streaming media.

By Jan Ozer

RealNetworks' G2 technology has been a public work in progress for so long that remembering what came before it is difficult. But make no mistake: RealSystem G2 is nothing less than a radical redefinition of streaming media that proves that small, focused companies can run circles around the Microsoft mothership.

The most significant new additions are support for Synchronized Multimedia Integration Language (SMIL) and two new formats, RealPix and RealText. SMIL enables the synchronization of multiple media types, with client-side effects such as dissolve transitions between images and zoomed and panned text.

SMIL lets Web developers deliver more compelling content at low connection speeds. It also lets

scalable audio/video format that lets one compressed file service multiple connection bandwidths while dynamically adjusting data flow to changing line conditions.

In addition, our tests revealed that, for most clips, G2's improved audio/video codecs deliver the best quality on the market. RealNetworks has upgraded its free encoder to produce both live and on-demand SureStream files and single-bandwidth files, if desired.

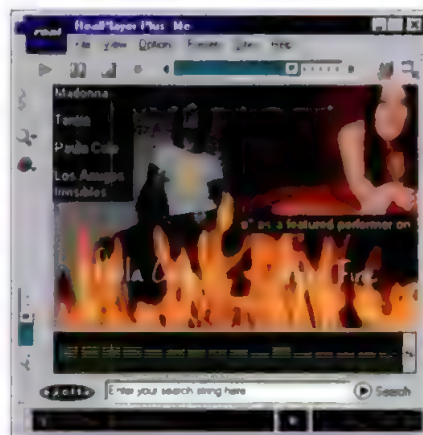
On the server front, Real now enables remote administration via a browser and offers improved integration with Microsoft BackOffice. A new customizable interface lets network administrators highlight statistics important to their installations.

Other than SMIL, the most

dramatic improvements relate to RealPlayer. Most are extremely useful, such as an auto-update mechanism that supports new technologies with downloadable plug-ins rather than complete re-downloads of RealPlayer.

From the developer's perspective, only Microsoft NetShow is also worthy of consideration because it's free. Developers of mission-critical audio/video content, however, should probably pay Real's license fees to access G2's superior formats and more sophisticated encoding tools.

RealSystem G2. Price: Free for encoder, player, and limited-function 25-stream Internet server and 10-stream intranet server; intranet servers start at \$5,000 and Internet servers at \$6,000 for 100 seats. Requires: 16MB RAM, 8MB hard disk space, Microsoft Windows 95, 98, or NT 4.0. RealNetworks Inc., Seattle; 800-444-8011, 206-674-2700; www.real.com; 409 at www.pcmag.com/infolink.



REAL CONTENT: SMIL adds to G2's usability and interactivity.

media broadcasters add hyperlinked text and graphics to their video transmissions, increasing usability and interactivity.

The final release of G2 also marks the debut of SureStream, a

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Trading Up

Internet Trader Pro empowers investors with potent market analysis tools.

By Stephen W. Plain

Online trading is enormously popular, and powerful desktop analysis tools are in high demand. Window on WallStreet Internet Trader Pro 7 (\$499.95 direct), part of the vendor's namesake line of products, puts power in the hands of any investor. By dishing up both intraday and historical security data, the program enables sophisticated and immediate analysis.

The driving force behind the program is the vendor's own Financial Data Cast Network (FDCN), an information service that pushes trading and news information to the company's desktop applications. Internet Trader Pro comes with free access to FDCN (which has a 15-to-20-minute delay).

The program's interface comprises MDI child windows that can display charts, quote-list spreadsheets, news headlines, or a portfolio window. This flexible user interface lets you quickly bring up sets of workspaces to analyze specific market segments, perform ad-hoc examinations, and try out hypothetical trading systems.

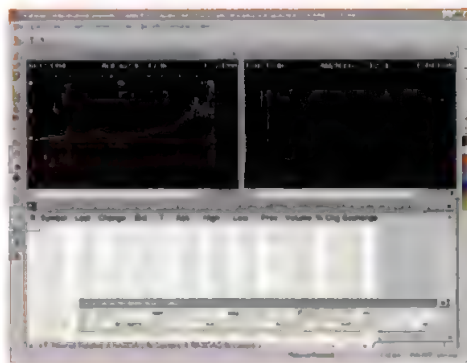
The quote-list workspace offers a continuously updating spreadsheet with up to 45 customizable columns that can include price and volume statistics, as well as such fundamentals as PE ratio, 52-week statistics, EPS, and shares outstanding. The chart workspace complements the quote list with flexible chart types and a continuous-zoom feature that lets you drill easily in and out of charts.

You can also superimpose the over 100 included indicators against individual charts with a couple of clicks. The news work-

space lets you monitor news and includes alarms to alert you of breaking headlines.

A welcome feature is the Personal Investment Assistant task scheduler. You can instruct the Assistant to download security statistics, generate and print charts, and use the program's SmartScan Plus feature to scan the market.

The program includes plenty of tools for professional analysis and decision support. Customizable indicators let you perform profitability and system testing



TRACK YOUR DATA: *Internet Trader Pro lets you keep tabs on just the data you want, from a live ticker to sophisticated historical charts.*

on past stock performance and establish your future trading strategies. The company's Rational Analysis Technology Expert (RATE) combines fundamental and technical analysis tech-

niques and is included with the product.

Though Window on WallStreet Internet Trader Pro offers top-notch desktop analysis, it meets the needs of casual market enthusiasts as well. The program is approachable, and the interface is flexible enough to meet your day-

to-day needs.

Window on WallStreet Internet Trader Pro 7. Direct price: \$499.95. Requires: 16MB RAM, 20MB hard disk space, CD-ROM drive, Internet access, Windows 95, 98, or NT. Window on WallStreet Inc., Richardson, TX; 800-998-8439, 972-783-6792; www.windowonwallstreet.com; 402 at www.pcmag.com/infolink.

A New Mac OS Release

Mac OS 8.5 brings better performance and a great search engine, but is it worth the price?

By Tom Pope

With the success of the iMac under its belt, Apple Computer Corp. is on an upswing. Mac OS 8.5, though not a hugely ambitious release, provides new features, performance increases, and improved stability. But is the \$90 upgrade price justified?

Mac OS 8.5 contains much more PowerPC-native code than any previous release, which means that Power Mac users

will see improved performance in almost every area. But it also means that owners of pre-PowerPC Macs (those that use the Motorola 680x0 series CPU) will be left out.

Several portions of the Mac OS have been reworked to improve stability, particularly the Finder. The Finder's resource fork is now read-only, which in many cases will prevent its accidental corruption. In addition, many control panels have

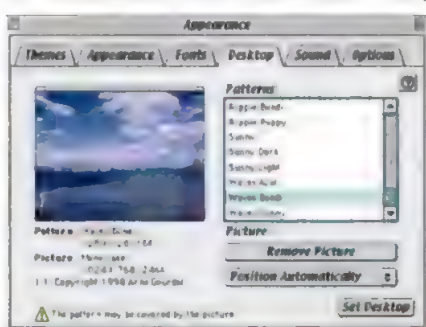
been made into applications, which reduces the chance of conflicts with extensions, other control panels, and traditional applications.

The most appealing new feature of Mac OS 8.5 is Sherlock, a new search engine. In addition to the file-finding capabilities found in Mac OS 7.5, Sherlock adds the ability to search for text within any document. What makes Sher-

lock really impressive is its ability to search for content on the Internet, rank the results by relevance, and include a summary of the site and a link in the search window. Other new features include QuickTime 3.0, a much faster and more extensive online help system, 32-bit color icons, systemwide anti-aliased text, and a few dozen other improvements. And as we were completing our evaluation, Apple released the Mac OS 8.5.1 Update, which fixes a number of bugs found early in Release 8.5. You can download the update at www.apple.com.

Although all these new features and fixes make for a decent incremental OS update, we still have to wonder if it's worth the \$90 price. If you spend much time doing research online, then Sherlock alone is worth the expense. But if you're happy with the way your machine runs under Mac OS 8 (or 7.x), then you may want to hold off until the release of Mac OS X next year.

Mac OS 8.5. Street price: \$90; upgrade prices vary. Apple Computer Corp., Cupertino, CA; 408-996-1010; www.apple.com; 403 at www.pcmag.com/infolink.



ROLLED INTO ONE: *The new Appearance control panel consolidates the functions of several different control panels found in previous versions.*



COMPAQ

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Calling on the Net

Net2Phone brings Internet telephony into the price race with conventional telephony.

By Bruce Brown

The quality of software-based PC-to-telephone connections via the Internet has improved, but aggressive pricing by conventional telephone service networks has limited the savings of PC-based Internet telephony, at least for domestic U.S. calls. A new pricing structure for IDT Corp.'s Net2Phone PC 9.0 (a free download from www.net2phone.com), effective January 1, 1999, drops the cost of U.S. domestic calls to an around-the-clock 4.9 cents a minute, and ups the ante.

To start using Net2Phone PC 9.0, you download and install the software and plug a microphone and speakers into your PC's sound card jacks. You then register and set up a credit card-based account. With a half-

duplex sound card, you must click on an on-screen button to talk and release it to listen; using a full-duplex sound card, a new capability with this version, the experience is closer to that of conventional telephony.

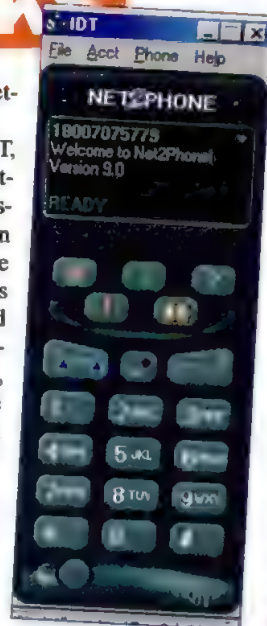
Net2Phone PC 9.0 lets you call any conventional phone in the world using a PPP Internet connection. Voice quality isn't as good as with conventional phone service; the quality of a call depends on the caller's PC system resources and on the speed and quality of the IP connection.

In testing from a variety of phone systems, PC-to-phone calls were consistently understandable; minor echoes, breaks, and variations were common though not constant. Earlier Internet telephony often suffered from annoying delays; these were not

noticeable with Net2Phone PC 9.0.

According to IDT, 80 percent of Net2Phone PC 9.0 customers have been from outside the U.S. The previous price structure did not offer much advantage in the U.S., but the new price will make the slight voice quality trade-off worthwhile.

IDT offers two other consumer products with compelling pricing structures. Net2Phone Direct, which uses the Internet to transmit calls between conventional telephones without requiring the use of PCs, costs 5 cents per minute for domestic calls. Click2Talk, a Web commerce telephony tool, lets



FULL-DUPLEX CALLING:
Make simultaneous two-way calls with Net2Phone.

you place a call via your PC to a Web site company representative for information about products or service, at no cost to either party.

Internet telephony is enjoying incremental increases in voice quality and drastic decreases in price. The bottom line: You can save money by using the Internet to make phone calls.

Net2Phone PC 9.0. Free download. Requires: 8MB RAM; 4.3MB hard disk space; Microsoft

Windows 3.x, 95, 98, or NT 4.0 or later; IDT Corp., Hackensack, NJ; 800-438-8879; www.net2phone.com; 407 at www.pcmag.com/infolink.

Penny-Pinching PDA

The Royal daVinci will help you stay organized at a fraction of the cost of a Palm or CE device.

By Carol Venezia

Everyone wants to be organized, but let's face it: If you want to do so electronically, you probably think it entails shelling out \$300 to \$400 for a Palm or Windows CE device. For those willing to make a few sacrifices along the way, however, the new Royal daVinci palm-size organizer is an alternative for only \$100 (street).

The first thing you'll notice about the device is that it looks a lot like the popular 3Com Palm III connected organizer. The daVinci measures about 5 inches tall by 3 inches wide and has a flip-top cover to protect the screen. The screen itself is backlit, and it's about the same size as what you'll find on a Palm device. The daVinci's screen suffers from major glare problems,



KEY FEATURE: The daVinci has an optional foldable keyboard.

however; seeing what's displayed is difficult even with the backlight turned on.

The daVinci offers many of the same applications as other PDAs, including a phone list, to-do list, daily planner, and calculator. All of these functions can be launched by tapping on small

icons that run along the top of the screen. There's also a note-taking application; you can use either Royal's daVinci Script (which is much like Palm's Graffiti) or a small folding keyboard, which is a \$20 option. And a daVinci Script cheat-sheet is included on the inside of the flip-top cover, which proved helpful in getting started.

Included with the package is the PIM for daVinci application, a personal information manager that duplicates the phone book, to-do list, planner, and memo functions on your desktop PC. You can synchronize this information with your daVinci via the included cradle, which connects to your PC by a serial port. One gripe: To put the daVinci into the cradle, you must first remove a small plastic door, which you'll likely lose in no time flat.

The daVinci can also be synchronized with popular PIMs

such as GoldMine, Lotus Organizer, Microsoft Outlook and Schedule+, and Symantec Corp.'s ACT! via Companion-Link software, a \$40 option (order online at www.windowmlink.com). You may not be able to get as much information into the device as you can with Palm systems, however, because the daVinci has only 256K of memory (compared with the 1MB to 2MB found in 3Com organizers). This amount will hold thousands of entries nonetheless (and the company expects to ship a 2MB version in February).

The Royal daVinci is a decent PDA pick at a bargain-basement price.

Royal daVinci. Street price: \$100. Requires: 8MB RAM, 12MB hard disk space, Microsoft Windows 95 or 98. Royal Consumer Business Products, Bridgewater, NJ; 888-261-4555, 908-526-8200; www.royal.com; 412 at www.pcmag.com/infolink.

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CDPD For Windows CE

The Sierra Wireless AirCard 300 for Windows CE is a CDPD modem that gets it right.

By Bruce Brown

The relentless need for constant connectivity is driving companies to create great mobile products. The Sierra Wireless AirCard 300 for Windows CE (\$499 list) is just such a product. The AirCard 300 is a wireless Cellular Digital Packet Data (CDPD) modem that runs on Windows CE 2.0 H/PC devices and Professional/Jupiter H/PCs.

The CDPD network is an overlay to standard cellular net-

works and operates at 19.2 Kbps. Major carriers such as Ameritech, AT&T Wireless, Bell Atlantic Mobile, GTE Wireless, and SNET offer CDPD. Service contracts currently range from approximately \$55 to \$70 per month for unlimited access.

The AirCard 300 for Windows CE has two distinct advantages over other CDPD modems: design and battery power consumption. The Sierra Wireless card is a Type II PC Card with a

small removable antenna that plugs into the end of the card. Though PC Cards traditionally have a hefty power draw, the AirCard 300 is rated to decrease the battery life by just 15 percent when used with the HP 620LX, HP 660LX, HP Jornada 820, NEC MobilePro 750C, and Sharp Mobilon TriPad.

For use with other H/PCs or if you don't want to relinquish any battery life from one of the listed H/PCs, the AirCard 300 is also available (\$549 list). It comes with a rechargeable lithium ion battery and charger and is rated to last 16 working hours on a single charge (based on receiving 15



ON THE ROAD: The AirCard 300 connects Windows CE devices to the CDPD network.

1,200-byte messages per hour).

During software installation, two applications are installed on the Windows CE device. The Wireless Expert setup program lets you configure the modem by entering DNS, TCP/IP, and other information provided by the cellular provider. After the modem has been installed, you need run only a Watcher program from the Windows CE desktop, which establishes and monitors the remote connection with the CDPD network.

Once the AirCard 300 is installed, configured, and connected, you can browse the Internet via Pocket Explorer and use the Windows CE Inbox application for e-mail. In testing with an NEC MobilePro 750C, the AirCard 300 maintained the CDPD network connection consistently for hours at a time.

The AirCard 300's small size, conservative power consumption, ease of installation, and robust performance make it a powerful tool for road warriors and office rovers alike.

Sierra Wireless AirCard 300 for Windows CE. List price: \$499; with Power Pack, \$549. Requires: Windows CE 2.0 or later, H/PC or H/PC Professional, 4MB RAM, Type II PC Card slot. Sierra Wireless Inc., Richmond, B.C., Canada; 604-231-1100; www.sierrawireless.com; 406 at www.pcmag.com/infolink.

In the Works

Microsoft Works 4.5 for Windows 95, with dozens of office-task wizards, is almost a suite.

By Edward Mendelson

Users who don't need an industrial-strength suite such as Microsoft Office but want its luxuries and conveniences should take a look at Microsoft Works 4.5 for Windows 95 (\$54.95 list). It includes a word processor, a spreadsheet, a database, a communications module, and the same add-on modules used by Office for sticky notes, clip art, and drawing.

You can create letters, newsletters, and dozens of other document types using wizards. Smooth integration among the modules takes the headaches out of mail merge; the program automatically updates a chart in a report document when data changes in a spreadsheet.

Users of Version 4.0 will find the same interface. But because the program now comes on a CD-ROM, you get 7,000 clip-art images, the simple Microsoft Works Calendar, and extra document templates. Works Deluxe 99 (\$84.95) adds Money 99 Basic and Greetings 99, a greeting card maker, to the main package;

Works Suite 99 (\$109) adds Encarta Encyclopedia and Expedia Streets to the Deluxe package.

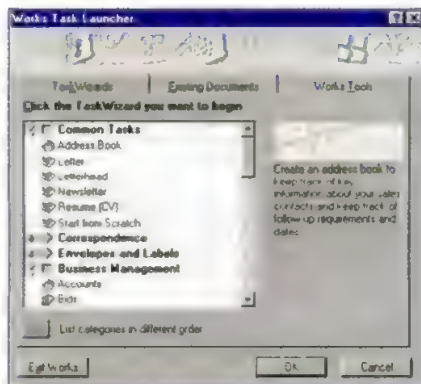
Works 4.5 looks and feels more like Microsoft PhotoDraw and Publisher than like Excel or

must make extensive changes to sample letters by hand before you can use them for your own purposes. And because the word processor's page view shows only one page at a time, you have to switch to draft view to see the whole of a sentence that crosses a page break.

Internet Explorer 4.01 comes in the box, but Works 4.5's built-in communications module is an old-style terminal program with no Internet-related functions. If you use Windows 98, don't follow the help file's instructions for sending a

fax, because the information given applies only to Windows 95. Works 4.5 works in exactly the same way in Windows 98 as in Windows 95.

Works 4.5 is a bargain, and for many nonexpert users, it will be all the software they'll ever need. **Microsoft Works 4.5 for Windows 95.** List price: \$54.95. Requires: Windows 95 or NT 4.0 or later, 16MB RAM, 125MB hard disk space. Microsoft Corp., Redmond, WA; 800-426-9400; www.microsoft.com; 404 at www.pcmag.com/infolink.



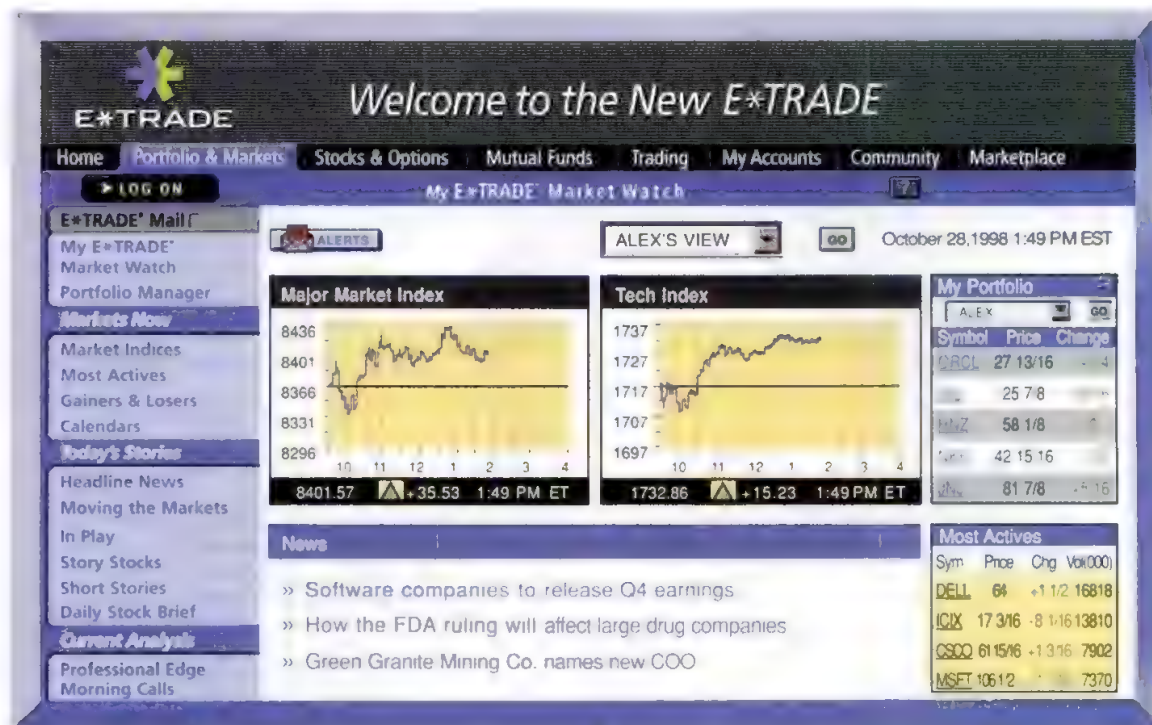
EASY SUITE: Works 4.5's File/New menu leads to a list of predefined wizard-driven tasks.

Word. A huge help panel occupies the right-hand side of the screen, and the mouse pointer sprouts labels to tell you what will happen if you move selected text or graphics.

The program opens by displaying a list of wizard-guided tasks; you can create an empty file in the word processor or spreadsheet only when you switch to a dialog that's initially hidden behind a tab. The wizards let you specify your business address and chosen format in any order you prefer. But you

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Video Roadie

Two new products from PAR Technologies bring videoconferencing and video capture to laptops.

By Jan Ozer

Until recently the phrase *laptop video* was an oxymoron, with undersized disks and slowpoke processors a bad match for digital video's horsepower and bandwidth requirements. But today's Pentium II notebooks with 4GB of storage are plenty powerful for video production, and 56K modems are making Internet videoconferencing usable. Laptop video is becoming a real market.

Hoping to grab a share of this market is PAR Technologies, the exclusive distributor of two products manufactured by Irez Research Corp. The PAR CapSure, a video capture PC Card (\$129 list), is a great value for video producers needing to create prototypes on the road. If your notebook doesn't have a USB port, you should consider the PAR Kritter—a PC Card-based digital camera for Internet videoconferencing (\$249.95 list)—though users with USB-equipped laptops can find cheaper, better-featured, and better-performing USB cameras.

THE CAPSURE

The CapSure is a Type II PC Card that requires a Zoomed Video slot, so check the laptop-compatibility guide on the PAR Technologies Web site before buying. The card supports both S-Video and composite-video inputs, with audio captured by the laptop sound system. PAR bundles VidCap32 but not a video editor, which you'll need to edit and output your captured video files.

The CapSure supports NTSC, PAL, and SECAM video standards, important for international

users, and captures in RGB and YUV 4:2:2 formats in any resolution from 80-by-60 to 960-by-720. Slider bars adjust the saturation, hue, brightness, and contrast of the incoming video, though the controls lack numeric values, complicating precise adjustments.

We tested the CapSure on a

266-MHz Pentium II Dell Inspiron 3200, capturing from a Sony DCR-TRV9 DV camcorder. During our initial captures, we noticed a line of black pixels on top of the captured video, which we corrected with an alignment program included with the product.

In performance testing, the CapSure successfully captured 15 frames per second (fps) at 320-by-240 resolution, but it choked at 30 fps, dropping approximately 35 percent of the frames during our 2-minute test capture. Its capture rates are adequate for CD-ROM and Internet distribution but not for MPEG-1 or MPEG-2 production.

To assess quality, we compressed the captured footage to Indeo 5.0 format and compared the results with similarly processed video captured directly from the DCR-TRV9 via

a FireWire device. At 1X resolution, the files appeared similar in quality, though the DCR-TRV9-captured footage was clearly superior when zoomed to 2X.

In test captures at 176-by-132 resolution, appropriate for streaming video, we noticed significantly higher pixelation than with video captured at 320-by-240—an unusual result. These results make the CapSure ideal for field prototyping, but you should use a higher-quality desktop tool for final production.

One bonus of the Zoomed

Video port is the ability to display full-screen (960-by-720), full-motion video on the laptop LCD, a convenient big-screen output for analog-based presentations. On the Inspiron, video output was

handy foldout, which doubles as a lens cover.

The Kritter is a video-only device, with the laptop sound system capturing audio. It's capable of shots as close as 1 mm away. You focus the camera using a black ring around the lens.

Incoming-video adjustments include brightness, contrast, saturation, hue, and sharpness. The white balance, exposure, and gain controls are all automatic, though the company plans to add manual adjustments and gamma control in the next version.

In test captures with the bundled VidCap32, the Kritter performed similarly to the CapSure—not surprising, given that they share common capture hardware. Specifically, the Kritter captured 15 fps at 320-by-240 resolution, more than sufficient for Internet-based videoconferencing and video e-mail.

Video quality was sharp and smooth, easily superior to that of most parallel-port cameras and similar to that of most USB cameras.

The PAR Kritter proved compatible with the bundled software CUSeeMe as well as with Microsoft NetMeeting, and it should perform well in most Internet videoconferencing and video e-mail applications.

Though still-image capture quality was also high, VidCap32 is harder to use and less functional than programs shipped with other desktop video cameras, and PAR doesn't offer a Twain driver. For this reason, though PAR bundles Kai's Power Goo and Photo Soap with the Kritter, it's not a great tool for still-image capture.

PAR Kritter. List price: \$249.95. Requires: 16MB RAM, 20MB hard disk space, Microsoft Windows 95 or 98. PAR Technologies, Scottsdale, AZ; 602-922-0044; www.partec.com; 400 at www.pcmag.com/infolink.

THE KRITTER

The PAR Kritter is a small, egg-shaped camera with a dedicated cable to a Type II PC Card; it also requires a Zoomed Video port. The lightweight camera attaches to the top of your notebook's LCD panel via a



VIDEO ON THE GO: The CapSure and Kritter produce fine results for videoconferencing and e-mail.

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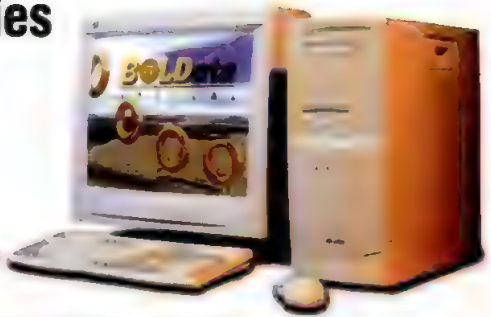


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All-Around Photography

CycloVision's ParaShot lowers the price point for immersive digital photography.

By Bruce Brown

The CycloVision ParaShot (\$995 list) may be the best choice yet for taking 360-degree photographs without breaking production budgets. Too costly for occasional amateur use but reasonable for commercial users and avid hobbyists, the ParaShot works with the Agfa ePhoto 1680 or Nikon CoolPix 900 cameras to capture donut-shaped images. These images are then unwrapped via software for panning and zooming using a browser. Adapters to use the ParaShot with other digital cameras are planned for 1999. We tested with an Agfa ePhoto 1680, and the device was easy and fun to use.

The ParaShot consists of a parabolic mirror, a relay lens, and a slip-ring with a removable

adapter that screws onto the lens of the Agfa and Nikon cameras. Tripod mounts on each end of the ParaShot let you attach the camera with the mirror facing up or down, depending on the vertical angle of your shot.

When you take a photograph using the ParaShot, the created donut-shaped image actually represents a 360-degree horizontal, 210-degree vertical view, terrific for horizon or location shots outside or for virtual-reality tour-style shots inside. After you transfer the image to your PC, the included ParaShot Viewer software lets you center and mark the outside and inside rings of the image donut, which you then can preview in continuous panoramic mode using Live Picture's Live Picture Viewer. You control panning,

tilting, and zooming with mouse buttons and cursor keys.

You can publish HTML pages using the ParaShot images in two quality modes—one for Web viewing and the other for CD-ROM image-quality desktop-publishing use. The publishing process automatically generates HTML code, so you can use Live Picture Viewer for perusing the images with a Java-enabled browser.

The ParaShot creates and processes a single image rather than multiple images, and external, extra-cost image processing services aren't required. Be Here Corp.'s Portal S1 Capture System is another single-image solution, but it costs \$4,995.



TAKE A SHOT: The ParaShot takes single-image 360-degree photos.

The ParaShot is relatively simple to use and is aided by clear documentation. For shots of store interiors, photographs of real estate listings, or interesting exterior shots, CycloVision's ParaShot has made producing immersive images easier and less expensive. **CycloVision ParaShot.** List price: \$995. Requires: 32MB RAM; 21MB hard disk space; CD-ROM drive; Java-en-

abled browser; Windows 95, 98, or NT 4.0 or later; Agfa ePhoto 1680 or Nikon CoolPix 900 digital cameras. CycloVision Technologies Inc., New York; 212-499-0909; www.cyclovision.com; 408 at www.pcmag.com/infolink.

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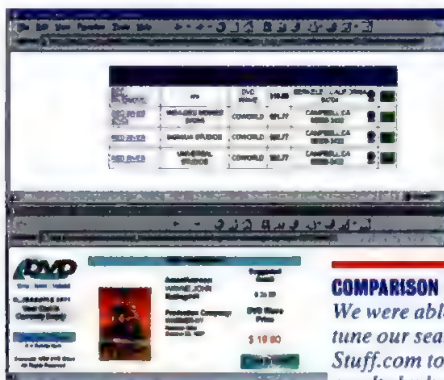
Stuff.com e-commerce solutions and comparison shopping are a boon to merchants and consumers.

By Jim Lynch

More and more businesses are out to capture the dollars of online consumers, who are getting better at bargain hunting online. But finding the best deal isn't always easy; there are lots of commerce-enabled sites out there, and wading through them one at a time can be time-consuming.

So it's not surprising that a wave of sites devoted to aggregating online merchants has appeared. Consumers can visit a shopping supersite and quickly search for the best price on products that interest them.

Stuff.com is one of this new breed of sites. Created by iMALL, Stuff.com offers a wide



COMPARISON SHOPPING: We were able to fine-tune our search on Stuff.com to show results by keyword, price, merchant, and manufacturer.

variety of products from an array of affiliated merchants. Consumers can search Stuff.com's database to find products that interest them or to check prices from various merchants.

We tested Stuff.com's search mechanism by looking for a number of different products, including DVD movies and var-

ious computer games. We were able to refine our searches with options such as keyword, price, merchant, and manufacturer.

Our search for the DVD version of the classic Western *Red River* brought up two vendors with different prices. This sort of price comparison is what makes searches on Stuff.com really useful.

Stuff.com also helps Web sites that want to try online commerce. Aspiring merchants can create storefronts or add transaction capabilities to their sites by choosing from several different e-commerce solutions.

A "bolt-on" e-commerce option lets merchants add product graphics, descriptions, and prices to a database on Stuff.com. Services include secure,

real-time credit card transactions, and account services. Other e-commerce services include order processing, shopping cart, tax calculation, searching, and product database management.

Stuff.com offers system architecture support, with product catalog and secure payments hosted on iMALL.com and round-the-clock support for your site. Redundant Internet access and a scalable server architecture are also part of the infrastructure support program.

So if you're looking for the best price on a product, or if you're a merchant wanting to give e-commerce a try, Stuff.com might be worth checking out. At the very least, consumers will be able to do some comparison shopping, and merchants might find an easy way of gaining new customers.

Stuff.com. Price: Free. iMALL Inc., Santa Monica, CA; 310-309-4000; www.stuff.com; 405 at www.pcmag.com/infolink.

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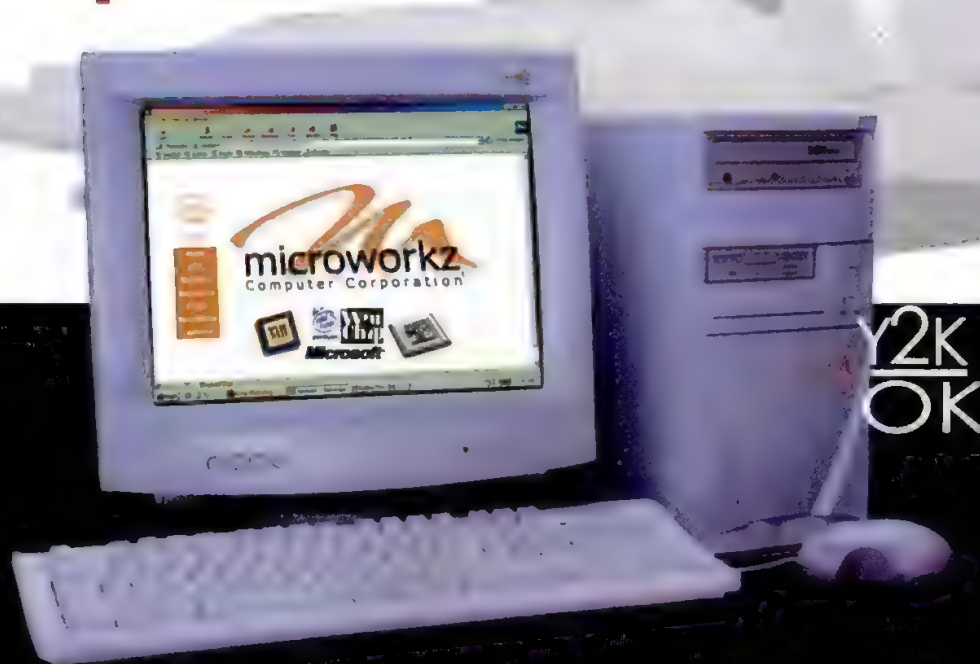
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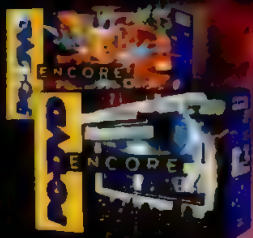
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Shortcut to the Internet

Of all the roads your business has to the Internet, the WebRamp 310i may be the easiest.

By Steve Rigney

Most networks of 25 users or fewer have yet to reach the Internet. Unfortunately, the price can be high, and availability can be limited. One popular alternative to the traditional leased line, Frame Relay circuit, and ISDN is to use a software product, such as Windows NT RAS, to combine multiple analog modems together. But this route requires technical skill and, in some cases, a dedicated system. A better course for the small business would be a standalone Internet router with the ability to connect to both analog and digital ISDN modems. Fortunately, we found one that might fill the bill.

The Ramp Networks WebRamp 310i (\$849 list) is a relatively inexpensive solution that includes a turnkey router with two V.90 56K internal modems, a four-port 10-Mbps Ethernet hub, and a separate serial port for analog and ISDN modems. The 310i can connect to the Internet, other LANs, or allow dial-in access from a remote location.

phone number, username, and password. To connect the 310i to a larger hub, we simply used the uplink port; all of the users on the test LAN were able to connect to the device.

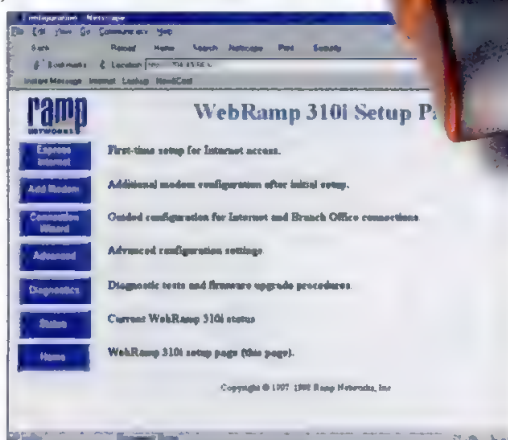
Things become more complicated when you add the device to a larger LAN. For example, when we tried to connect the 310i to a network with static IP addresses and with an existing DHCP and DNS server, we could not see the device. It was not until we connected a single client PC and changed the IP address of the PC that we were able to find the unit and configure it. Further, we had to

about the 310i. Among our favorite features is the ability to combine—or bond—two or more dial-up connections to increase bandwidth.

The 310i offers two options for bonding: a proprietary Connection Optimized Link Technology (COLT) method and the standard Multilink PPP (MLPPP) method. COLT helps the 310i increase the performance of your connection to the Web by using different modems to download different parts of a Web page.

For example, one modem can download the banners,

ALL IN ONE: The WebRamp 310i can bring the Internet to the entire office.



while the other can download the links. Note that COLT increases performance only for surfing the Web and not for other connections, such as e-mail, telnet, or FTP.

MLPPP takes this approach further and actually combines the

bandwidth of two or more connections. This means that everything you do—including surfing the Web, downloading files, or sending and receiving e-mail messages—will be faster. Your ISP must support either COLT or MLPPP to use these bonding features.

IT'S A ROUTER, TOO

Many organizations will use the 310i to connect to the Internet, but that's not all the device can do. The 310i is a full IP and IPX router and bridge. This means

that we were able to use the device to link two remote LANs together. Because the unit works with IPX, we could use the router to connect to a remote server running NetWare—in addition to all of the IP devices. The 310i also let us dial-in to the network from a remote location.

To protect your valuable assets, the 310i includes Access Control Lists (ACLs) that let you determine what resources individual users can access. On our tests, we successfully restricted FTP access for one group of users but allowed them to surf the Web and send e-mail messages.

Virtual Private Networks (VPNs) tunnels are a hot topic, and Ramp Networks touts this ability in the 310i. VPN tunnels allow you to encapsulate or hide IP or other protocols inside

a standard ISP connection, letting users send private information across the public network. Ramp Networks wanted to include the ability to originate a Point-to-Point Tunneling Protocol (PPTP) connection inside the unit, but due to licensing problems, had to settle for simply passing the PPTP packets through the device—something almost every router on the market can do.

In addition to the WebRamp 310i, Ramp Networks also offers the 310e model, which doesn't have the two internal modems but instead offers three external serial ports. The 310e is a good solution for administrators who already have modems or want to use three ISDN connections.

Ramp Networks WebRamp 310i. List price: \$849. Ramp Networks, Santa Clara, CA; 408-988-5353; www.rampnet.com; 903 at www.pcmag.com/infolink.

INSTALL

The folks at Ramp Networks claim that the 310i is a snap to install and they are half-right. For example, if you are installing the device in a small network without an existing DNS or DHCP server, you should have no problem: All you do is connect a client to one of the ports on the 310i hub and run the browser-based EasyStart utility. All we had to do at this stage was enter our ISP information, including

TAKE IT EASY: WebRamp 310i's browser-based software makes installation, configuration, diagnostics, and status reporting practically effortless.

change the 310i's IP address, disable the internal DHCP server, configure our existing DHCP server with the 310i's information, and finally go to each client PC to add a gateway and DNS address for the 310i.

BONDING CONNECTIONS

Beyond our mixed review of the installation, there's a lot to love

A Virtual Net for Less

The Cisco 1720 VPN Access Router can shave costs by providing all you need in one box.

By Les Freed

Virtual private networks (VPNs) shave communications costs by creating secure communications channels over the public Internet. Many organizations are finding that VPNs provide a cost-effective solution to leased lines and long-distance dial-up connections. But as we found out a few issues back ("Your Private Internet," *PC Magazine*, November 15, 1998), it takes lots of equipment (a router, a firewall, and a VPN tunnel server) to get a VPN up and running.

The new Cisco 1720 VPN Access Router (\$3,895 list as tested) combines a VPN tunnel server, a firewall, an IP router, and multiple WAN/LAN interfaces in a single box. The 1720 is designed to be at the client end of a VPN connection.

The 1720's rear-panel connections include a 10/100 auto-switching Ethernet interface, a console port for configuration, a low-speed serial port (for a modem or other backup link), and two WAN card slots. The card slots can accept a variety of Cisco interface cards, including ISDN, one- and two-port serial T1, WAN, and 56K leased-line cards. The cards are interchangeable with those used in Cisco's 1600, 2500, and 3600 product lines.

This flexible WAN interface gives users the option of starting with an inexpensive leased-line or ISDN connection, then moving up to full or fractional T1 line as needed. Both interfaces can

be active at once, and one can be used as a backup connection for the other. (Note that full-speed T1 won't be available until a hardware encryption board be-

initial LAN and WAN interface setup, you'll need to use Cisco's IOS command language to set up the VPN. A new release of ConfigMaker, due out early this year, will include VPN configuration tools.

Pricing varies according to the interface option you select. We tested the 1720 with a single ISDN U interface card. A T1 model (with a built-in CSU/DSU) would be \$300 more. At this price, the 1720 is cheaper than many less robust stand-alone VPN servers.

Cisco 1720 VPN Access Router. List

price: \$1,795, plus \$1,400 for firewall/VPN software, \$700 for ISDN

BRI interface, \$1,000 for T1 interface. Cisco Systems Inc., San Jose, CA; 800-553-6387, 408-526-4000; fax, 408-526-4100; www.cisco.com; 900 at www.pcmag.com/infolink.



STEP BY STEP: The 1720's ConfigMaker 2.2's drag-and-drop display helps you build your network



comes available midyear.)

We had our 1720 configured for an ISDN LAN-to-Internet connection in about 15 minutes, thanks to Cisco's ConfigMaker, a Windows-based configuration program. Once you've used ConfigMaker to perform the

Defrag Duty for Windows NT

Diskeeper 4.0 offers plenty of options for defragging your disks and helping your apps run faster.

By Steve Rigney

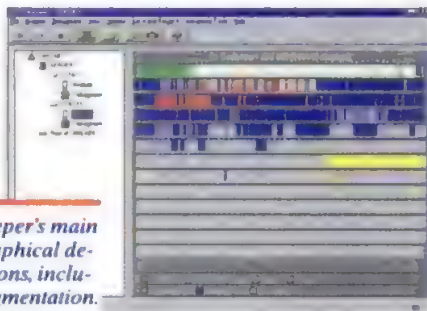
Microsoft first began bundling a hard disk defrag utility with DOS 6.0. That is why it is so amazing that Microsoft's flagship product, Windows NT, doesn't provide a similar application. Fortunately, Executive Software has filled this hole since Windows NT 3.5 with Diskeeper.

The new Diskeeper 4.0 comes in two network flavors: Diskeeper Server (\$399 list) and Diskeeper Workstation (\$75 list). The Workstation addition doesn't let you schedule defrag jobs across the network, but otherwise they are the same. It took only about 5 minutes to install both products and begin to defrag our hard disk partitions.

Diskeeper includes three dif-

ferent types of defragment jobs: at start-up, on demand, and on a schedule. The start-up job is the most powerful, as it lets you defrag the page file and directories. The only problems with this type of de-

VISUAL DEFRAG: Diskeeper's main menu shows you a graphical depiction of your partitions, including the state of defragmentation.



frag job are that you can't schedule it and you must reboot the server before you run it.

On-demand defragmentation is the easiest and required us simply to launch Diskeeper. When the main menu appeared, we had the option to analyze our hard disks or defragment them. You can view

the results of the analyze command in both a graphical and a text-based menu.

The ability to schedule disk defrag is the most useful feature for network administrators. We were able to set up Diskeeper

the defrag job would use. The lower the priority of the job, the longer the defrag takes, but the ability to prioritize is useful if you want to defrag a PC that is currently in use. You should note that you can schedule defrags only on PCs running Windows NT Workstation or Server that have copies of Diskeeper installed.

While there are other Windows NT defrag products out there (Norton's SpeedDisk for Windows NT and Raxco Perfect Disk, for example), Diskeeper was the first and is currently the only one to provide network scheduling and the ability to defrag page files and directories. Interestingly, Windows 2000 will include a scaled-down version of Diskeeper.

Diskeeper 4.0. List price: \$399 for Server, \$75 for Workstation. Executive Software, Glendale, CA; 818-547-2050; www.diskeeper.com; 901 at www.pcmag.com/infolink.

Talk Gets Cheaper

The Multi-Tech Systems MultiVOIP may be the low-cost solution for your company's calling needs.

By Les Freed

Organizations that have more than one business location can save money by using Voice over IP (VoIP) technology. These VoIP systems route intracompany, office-to-office voice calls over the Internet or your private intranet. Most of the VoIP products we've seen so far are aimed at large organizations that need dozens of simultaneous connections. (See "Goodbye, Phone Bill?", October 6, 1998.) Multi-Tech Systems, however, is bringing VoIP to small businesses with its MultiVOIP Voice over IP Gateway (\$1,749 list).

HOW IT WORKS

Like all VoIP gateways, the MultiVOIP piggybacks voice and fax calls over your existing IP network. It does this by digitizing analog voice phone signals from a telephone, phone line, or PBX extension, forming them into packets, and shipping them out over the IP network.

The MultiVOIP operating software includes several coding algorithms, or *coders*, that allow you to tune the MultiVOIP's bandwidth usage and packet-loss tolerance to your particular network. The standard coder provides very high quality using only 6.3 Kbps of bandwidth.

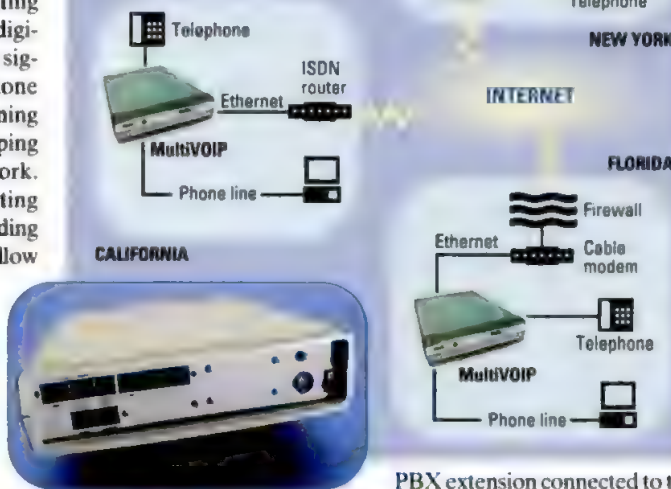
The MultiVOIP looks like a large modem. The rear panel has connections for two phones, phone lines, or PBX extensions, a 10Base-T Ethernet port, an administration port, and a connector for the external power supply. The front panel has 22 LEDs, including 8 for each phone port and 4 for the Ethernet port.

Multi-Tech provides everything you need in the box, ex-

cept for a 9-to-25 pin serial cable to connect the MultiVOIP to a PC for the initial configuration. Once you've performed the initial installation, you can manage the MultiVOIP—or a network of MultiVOIP units—remotely via telnet or a Web browser. The MultiVOIP is a standalone unit and doesn't require any special servers or software on the LAN.

Getting Connected

With the MultiVOIP, we were able to connect three of our offices, using three different Internet connection techniques: via ISDN router, via cable modem, and via corporate intranet. Our testers were able to make calls to each other by dialing unique codes, then opting to access either an outside line or a PBX port—or simply chatting.



CONNECTIONS FOR ALL: The rear of the MultiVOIP provides connections for nearly any combination of lines.

TEST DRIVE

To test the MultiVOIP, we set up three units, one each in California, New York, and Florida, and used three different connection techniques (see diagram). The California unit was connected to the Internet via an ISDN router, the Florida unit was connected to the Internet

via an @Home cable modem, and the New York unit was connected to the Internet via our corporate intranet.

We connected each MultiVOIP to one telephone set and one telephone line so our testers in all three states could call each other or make outbound calls on one another's phone lines. Each port on each MultiVOIP in a network has a unique dialing code associated with it. To connect to another location, you pick up the phone and dial a three-digit code or dial into the

outside dial tone. If the MultiVOIP is connected to an outside line, it will answer incoming calls on the phone line and provide dial tone from the MultiVOIP. This allows off-site callers to use the MultiVOIP to make calls over the IP network even when they're out of the office.

Each MultiVOIP must know the IP address and dialing code for the other MultiVOIP units on the network. Each unit can store its own IP address and dialing information, or one MultiVOIP can store all of the information for the other units. Changes to the main database are automatically sent to the other MultiVOIP units. The MultiVOIP provides standard dial tone, ring, and busy signals, so users may not even realize that their call is being routed over the IP network.

NO MORE MA BELL?

We used the MultiVOIP extensively for two weeks, intentionally making our interoffice and cross-country calls through the MultiVOIP instead of our usual dial-up long distance carrier. Calls were generally clear and free of echoes and other extraneous noise. We made hundreds of test calls using the outside lines, and most people we called couldn't tell that we weren't on a standard long-distance line.

Our sole complaint about the MultiVOIP is its lack of user controls. Any user can dial any other MultiVOIP and make calls, creating the potential for abuse. The MultiVOIP's logging and call accounting features are weak, so administrators can't get a good handle on who is using the MultiVOIP and where those users are calling. Multi-Tech is aware of these issues and plans to address them in future releases of the MultiVOIP firmware. **MultiVOIP Voice over IP Gateway.** List price: \$1,749. Multi-Tech Systems Inc., Mounds View, MN; 800-328-9717, 612-785-3500; www.multitech.com; 902 at www.pcmag.com/infolink. **PC**

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What Makes a Great Portal

By Jim Lynch

The word *portal* has become as much a part of the Web's vocabulary as the word *link*. Portals grew out of what were previously known as search engines and initially were just considered gateways to the Web. Sites like Excite, Lycos, and Yahoo! appeared as first-generation portals. But these sites quickly moved beyond offering just search capabilities and soon added services such as e-mail, stock quotes, and news.

But what exactly constitutes

a portal? More and more, it seems that other sites are moving into the portal space by adopting many of the large portal interface designs and by offering similar services. Sites like Animalhouse.com, Family Education, and even our own ZDNet have gotten into the portal game to some extent.

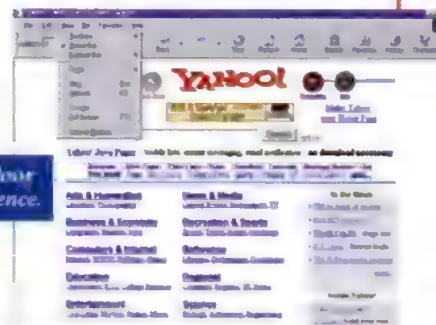
These sites have become what are known as vertical portals—that is, portals with a tightly focused content area geared toward a particular audience. Family Education, for example,

appeals mainly to parents and children. Sites like Excite, Net-center, and Yahoo! appeal to a much broader audience base and are considered horizontal portals.

The problem for horizontal portals lies in trying to differentiate themselves

similar range of services, along with a more tightly focused content offering. Over the long haul, sites like Excite and Net-

GATEWAY: Yahoo! is a front door to the Web for a broad audience.



from one another and in maintaining a strong value proposition for their audiences. This is not an easy task when the smaller, more nimble vertical portals offer a

center run a real risk of losing significant parts of their traffic to these new vertical portals.

Some people have had their fill of all portal sites and have decided to create their own. These users create their portal pages locally, fill them with their favorite links, and then use them as the default pages in their browsers.

The beauty of this idea is that it makes your site a personalized gateway to the Web. Anyone can do it; all it takes is the know-how to build one Web page. If the definition of a portal is a gateway to the Web, then this kind of personal portal might be the most successful one of all.

Are You Ready for Flat Panels?

By Alfred Poor

When it comes to desktop monitors, thin is in: LCD monitor sales have grown rapidly, although they will remain a small segment of the display market over the next few years. The big question is whether desktop LCD monitors will switch to using digital interfaces instead of analog.

Compaq gave the digital interface movement a big boost last summer with its Presario FP500 monitor, which we reviewed along with three other digital interface monitors in our issue of September 22, 1998. Our evaluation revealed that the digital interface yields significant benefits in both ease of use and image quality. What has happened in the interim?

The technology has taken two steps forward and one step back. Systems giants IBM and Gateway recently released digital-interface 15-inch LCD monitors: the IBM T55D and the Gateway FPD1500. The step back: Where as the Gateway monitor uses the same connector as the Compaq

model (based on the Digital Flat Panel) group's standard, IBM chose to use the Plug and Display standard championed by the Video Electronics Standards Association.

The good news is that the major players in the desktop system industry are working to settle on a single digital-interface and connector standard. The Digital Display Working Group was formed in September and includes Compaq, Dell, Hewlett-Packard, and IBM, among others. The group intends to release a specification in the first quarter of 1999.

In the meantime, digital-interface monitors are off to a slow start. According to DisplaySearch, only 5 percent of the desktop LCD monitors sold in 1998 have digital interfaces; this number is expected to grow to 17 percent in 1999. The share is expected to increase by 12 to 13 percent each year, however, with a projected share of 68 percent by 2003.

For now, the bulk of the digital

interface monitors will likely be sold as part of new systems, because the required digital-ready graphics adapter can be included in the system price at little or no cost increase. The upgrade market will probably stay with analog interface models rather than upgrade the display adapter at the same time. If a standard is settled soon, however, more graphics card vendors are likely to build adapters with both analog and digital connectors, which in turn may hasten the adoption of digital flat-panel monitors.



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Tell us what you think... How do you like the new products you're using? Second Looks is your forum for feedback. Join us online to tell us about your experiences. We discuss a different new product every week and summarize your comments here. Below, you'll see what people had to say about the way they use—or don't use—Web portals.

A friend of mine told me about MyYahoo! nearly six months ago. I have been using it ever since. It has really cut down on my surfing time, since I no longer have to go out to different news, financial, and sports sites to get the information I want. I have all the stocks I follow set up, as well as the weather in all the cities where my friends and relatives are. The portal fulfills all my needs.

—Subesh Ghose

I get all the news I need from reading newspapers—I don't need it pumped to my screen. At the office I have IE4 set to open to My Deja News. My WorldNet account opens to the WorldNet home page, because as soon as Navigator starts up, I'm firing up Pegasus Mail. Yes, I have a MyYahoo! Page, but I barely look at it when I check MyYahoo! mail, since I can start up the Yahoo! Ticker to see the important stuff. And the fact that MailCity now exits to My Lycos is a real annoyance; I stopped using Hotmail because it redirects to MSN Start.

—Paul Zorovich

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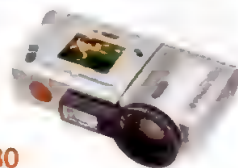
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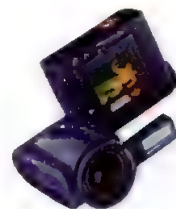
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High-Tech Stationers

Every time I walk past a stationery store, I want to go in. And I often do. I love all the papers, pens, pencils, pads, and rulers. They remind me of the summers of my youth, when my cousins and I would buy pads, grab pencils, and create a neighborhood "newspaper." Sometimes we'd get big newsprint

pads and play games for days, then break out the Venus Paradise colored pencils and be artists. I still carry a quadrille pad with me most of the time, along with a 30-60 triangle for sketching projects that I want to make out of wood or metal.

Stationery stores still have all that nifty stuff, but they also have a whole new breed of cool toys. One of my perennial favorites is the Brother P-Touch labeling machine. Every time I pick up one of these things, I want to organize everything—drawers in my shop, files, all those computer manuals that don't have the product name on the spine—you name it. Label printers have come a long way since the original device; now there's even a label maker for kids that includes games, party graphics, and a typing tutor.

My favorite, however, is the P-Touch PC, a label printer that you hook up to your PC. You can use your own fonts and graphics to produce custom labels, ribbons, and tapes in widths up to an inch. The tapes come in a dazzling array of colors, including metallics. The only limitation is that the printer's resolution is fixed at 180 dpi, and if you want what you see on-screen to appear exactly the same way on the tape, you have to make sure that your screen resolution in your graphics program is the same. Otherwise, you have to take scaling into account.

A fascinating offshoot of the P-Touch technology is Brother's stamp maker. With the Stampcreator, you use the same techniques as with the P-Touch PC to create graphics on a tape that becomes porous wherever printing appears. You apply this tape over an ink-filled medium, and whenever you press it to paper, the ink comes through the porous regions and transfers to the page. It's a small-scale but highly effective version of silk-screen printing, with none of the attendant hassles. (Did I tell you that I love stamps, too? You could probably have guessed.)

Because the ink medium comes only in black and red and is not changeable once you make the tape, such stamps are not particularly well suited for the burgeoning hobby of artistic stamping. But having your own graphics on a stamp is reason enough to

overlook the few shortcomings. Beyond the obvious uses as signature stamps and easy incorporation of company logos, the possibilities are limited only by your imagination.

Recommended Reading. Ray Kurzweil's new book, *The Age of the Spiritual Machine*, is a delightful follow-on to his previous, *The Age of the Intelligent Machine*. Kurzweil is one of the most original thinkers of our time, as well as an accomplished inventor, musician, and humanitarian. The earlier book was almost required reading for anyone who wanted to understand the implications of processing power all around us. This new one explores what happens when computers exceed the human brain's capacity for memory and association.

Kurzweil has never been one to shy away from a challenge, and he lays out a time line that takes us well into the next century. Many of his predictions are unsettling; most are merely bold. Yet he takes the time to detail the necessary developments in technology and shows that many are already well under way or firmly rooted in today's cutting-edge breakthroughs. The book is thoroughly readable, even though some of the ideas are challenging and highly compressed. You have to experience Kurzweil's writing firsthand to appreciate the way he summarizes the major themes of the 20th century in a footnote—in four neat sentences.

Will neural implants become as commonplace as he says? Will our thinking, interacting, and business behaviors be machine-assisted or machine-collaborative? Will computers become "spiritual," capable of shaded reasoning, complex associations, and rich interactions? I have little reason to doubt Kurzweil's hardware and technology estimations, but I have some fairly strong reservations about the software.

Still, we know that advances in genetics will challenge our moral precepts and will put the determination of what we are to become as a species into our own hands. This book shows that we are no less challenged on the technological front. **PC**



Stationery stores still have all the nifty stuff I remember from my youth, but they also have a whole new breed of cool toys.

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Nationalize Microsoft

Before you accuse me of being a socialist, let me tell you I was the biggest Republican supporter of deregulation in my town. I believe in the free market and all that, but being a capitalist doesn't mean being an anarchist. There's a reason we have a government, and it's not just to run an army or spy on enemies.

It's also to keep the conniving public in line and to prevent businesses from running roughshod over everything in their paths.

I make this disclaimer to minimize letters from people who think it would be OK if Microsoft actually took over all industry worldwide and ran everything and everyone. There are too many people out there who worship lockstep at the dubious altar of no-holds-barred competition.

Microsoft has gone too long as a mad dog on the loose. Thus, the only fair thing to do is to nationalize Microsoft and let the government run it. This seems to be the only way to stop these guys from continuing their nasty habits of leveraging their monopoly.

Microsoft has gone too long as a mad dog on the loose. Thus, the only fair thing to do is to nationalize Microsoft and let the government run it. This seems to be the only way to stop these guys from continuing their nasty habits of leveraging their monopoly.

What's going to happen to Microsoft? Most observers and even company insiders have finally realized that the government is never going to stop pursuing Microsoft until it changes its way of doing business. People who still do business with Microsoft say that it has been playing more hardball during the trial than ever before. I assume this is a reaction to the possibility of losing. Instead of being magnanimous, the company figures it should get what it can while it can and clear out of town with sacks of gold.

If every tale of Microsoft's greedy behavior were told, the company would never get out of court. Have Microsoft explain, for example, how Digital Research's GEM product was derailed years ago. This early GUI product preceded Windows and had a lot of interesting characteristics. But every deal to sell GEM was queered by Microsoft in backroom deals. These early stories of Microsoft's conduct will not be heard in court, though.

Yet Microsoft is one of the most admired companies in the world, and Bill Gates is seen as a fantastic genius for accumulating an ungodly amount of money. Criticize his wealth and you're branded jealous. Within a 15-year period, Gates has accumulated more wealth than the British monarchy, which has been robbing the world and its own people since the twelfth century. And this makes sense somehow? What's wrong with you people? I don't care how great a busi-

nessman Bill Gates is, this doesn't sound right to me!

I don't begrudge Bill his money. He hasn't flipped out yet or grown long fingernails or started wearing a cloak. But there is something wrong with this picture. If Gates is such a great businessman, let's see what he can do in some other industry by starting over. Nationalize Microsoft.

There's good reason to argue that Windows has become an "essential utility" the government should control. Gas and electric companies were originally private and regulated and essentially nationalized for the good of the country. Though Microsoft likes to whine about how bad government-designed software would be, the government did quite well designing software for the space program. And Microsoft can't approach the Social Security Administration for handling volume. Besides, if you haven't noticed, Windows crashes a lot.

Because Microsoft may have gotten where it is by wrongful methods, shouldn't it simply be taken over? I wouldn't go so far as confiscating the company like a drug dealer's gaudy Mercedes, but I think something along the lines of an eminent domain confiscation would be appropriate—with the government paying fair market value for the company's assets.

The typical outcome of an antitrust case is usually some sort of consent decree with continued oversight by a court. This will not work with Microsoft, which will forever be dragged into court saying it's complying while it continues anticompetitive practices. Regulating the software industry as a whole or Microsoft specifically would be impractical. Simply using eminent domain laws to nationalize the company is the only solution and the only way to reinvigorate innovation and competition. It will level the playing field and stabilize Windows, which has yet to be debugged.

In a culture where wealth is idolized like a god and where the rich can do no wrong (and if they do, buy their way out), this move is too gutsy and contrarian for our ethically challenged government and citizenry. But we can always hope.



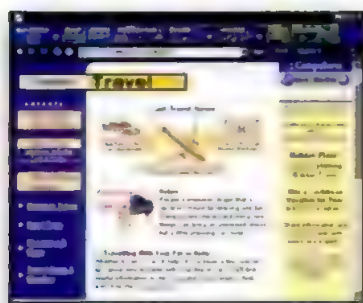
If Gates is such a great businessman, let's see what he can do in some other industry by starting over.

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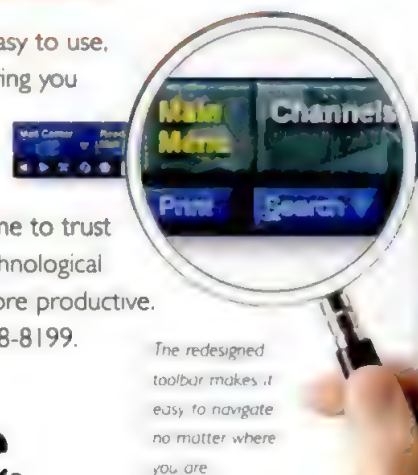


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John C. Dvorak's



INSIDE TRACK

I was at a convention recently where a speaker harped on "time to market" and **the importance of being first**. Each time I hear this bromide, I think of all the perfect examples of this. The first spreadsheet, Visicalc. Amazing how well it's done, right? Or the first desktop computer, the Altair. There's the first browser, Mosaic, and the first portable computer, the Osborne, and the first laptop, the Radio Shack Model 100. I could go on and on, but the point is obvious. Similar **ludicrous examples** refute the time-to-market argument. Microsoft comes to mind. The most successful company in the world is hardly setting records in this regard.

This brings me to the widespread **late-arrival syndrome**, which disproves the time-to-market litany. We're now beginning to see company after company bring out x86 clones in hopes of jumping into the sub-sub-\$1,000 computer market. Now if there was ever a late time-to-market product, I would have to say that an x86 clone in 1998 has to be it.

All computer users should also benefit from the **intense competition** taking place in the digital signal-processing arena, where some observers believe that Moore's law is being beaten back, as speeds are doubling every 12 months instead of every 18. Examples will show up everywhere. Dell announced recently, for example, that it will put an **ADSL modem on the motherboard** of certain Dell Dimension machines. This is possible because of the emergence of the DSP as an inexpensive part to be incorporated into all computer designs. Lucent is a big player here; the company has begun to dominate the modem business in general.

Which Brings Me to the Subject of DSL Dept.: The numbers I've seen regarding DSL growth are too low. This technology, as far as I can tell (and I speak from experience, since I have a DSL circuit), is **far superior** to any other **copper-wire-based** delivery system available. Unlike with ISDN, the central office switch doesn't have to be changed to an ISDN-capable switch. The DSL gear resides outside of the switch as an add-on.

I first heard of DSL about five years ago. There were **claims made that 500K service** would be available universally **by the end of 1994!** Back then, I recall discussing this with an AT&T researcher who believed that it would **revolutionize** data transmission and sweep the nation *that* year. A visit to a few trade shows broke that bubble, as it was apparent that various sub-rosa **battles** (including some over basic technology) would force a slowdown in rollout plans.

Over the next few years, **ADSL smelled a lot like ISDN to**

many people, and it still does. In fact it's not. It uses the regular phone line, which apparently can be segmented into channels. You keep your old analog line, and this service runs on a different frequency, "above" the phone service. There's also **room for a few more channels** on the phone line, and **home networking champions** intend to use the standard phone wire to squeeze in a network signal, too.

The real problem with ADSL will be marketing. Cable modems have achieved all the buzz and are faster and cheaper. As this is written, there are about 600,000 to 700,000 cable modem users. There might be 100,000 to 200,000 ADSL users—at most. But the fact is, ADSL is **more widely available than you'd think**. If you go looking for a provider, you'll probably find one. Unfortunately, getting ADSL takes more research than it should. I was promised ADSL by a number of vendors, but only Orconet in California (www.orconet.com) followed through.

The problem is that the phone companies are holding their central offices **hostage**. While they're supposed to deregulate, they instead keep independent phone companies and small ADSL operators out of the **juicy markets** like Berkeley. But the same phone companies can and will do ADSL joint ventures where they have a piece of the action. **This has created a confused marketplace**. Cable modem companies, specifically @Home—which understands marketing—can make hay while ADSL confusion reigns.

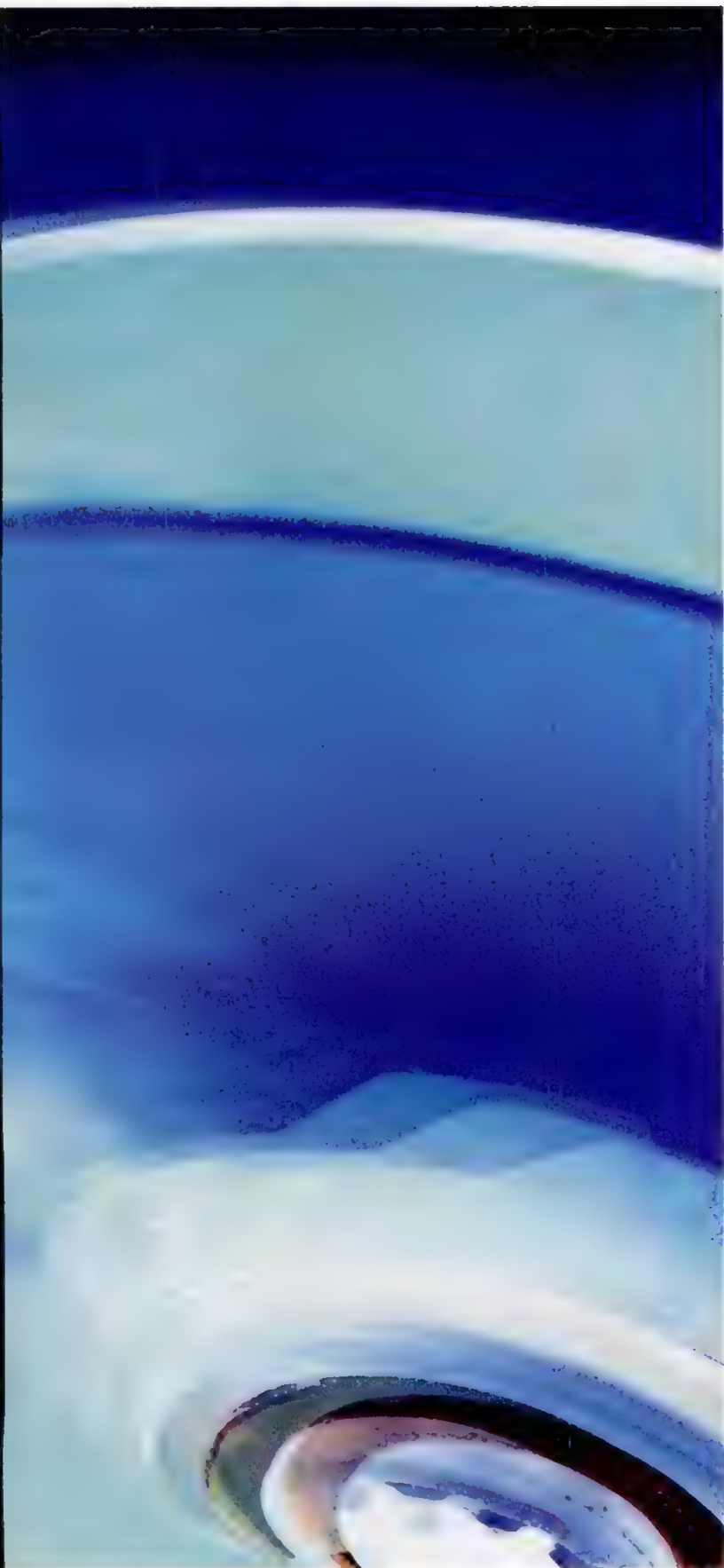
To make matters worse, the path to ADSL is **pitted with nickel-and-dime land mines**. You have to pay a fortune for installation. Pacific Bell charges \$250 for the wire (which you already have), and an installer will nick you up to \$600 to install four wires and turn four screws on a splitter and plug it into a modem. My 13-year-old could add this equipment.

A perfect example of small-time gouging is the modem and wiring that were sent to me by a Pacific Bell contractor. Though the modem and wires seem properly priced, there was a not-so-hidden shipping and handling charge of over \$80. The item was an 8-pound parcel shipped UPS ground freight **about 40 miles**. Inside were a modem, a strand of network wire, and two or three other small items. Exactly how it cost \$80 to throw these items into a box and ship them UPS is a mystery. **In fact, it's a rip-off**, and I'll be harping on this for some time, specifically to the Public Utilities Commission and other agencies. When I complained to the guy coordinating my site, he said, "Well, this is designed to go into small businesses. They usually don't object to these kinds of charges." **Oh, brother!** **PC**

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to-market
product,
I would have
to say that an
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in 1998
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PC Magazine, October 6, 1998 – page 202

It's one thing for a company to claim its products are the best. But when a publication like **PC Magazine** honors it with their respected Editors' Choice, you sit up and take notice. Optiquequest took the concept of a large screen monitor, combined it with a small footprint, and designed a winner – the 19" (18.0" viewable) **V95**.

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October 1998

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They Don't Have to Be Ugly

But they usually are. PCs and PC accessories, I mean. Relentlessly and needlessly. And I'm tired of it. Period. The notion of good design in PCs gets a lot of lip service, but—to judge from what we find on the shelves in the real world, ready to buy—not much more. While good design has become an im-

portant part of consumer and business products, PCs and related gear still muddle along, often failing the FF Test: form and function.

It's an obsolete, silly notion that we can't have both. All around us—and high-tech medical instruments are a great example—we see the results of industrial designers and product engineers working together to deliver products that work exceptionally well, and in which the aesthetic aspects of design actually advance the functionality of the product. Never think good design is about mere prettiness, though flat-out ugliness is unacceptable—and unnecessary.

It's a measure of how far we have to go in making good design an integral part of personal computers that the examples usually held up of high-style, high-function computing devices are so few—and often so far from fully realized designs.

The Apple iMac is the most recent example. I'm not as fond of it as some, but I'll concede that its designers broke the stranglehold of the Beige Box Rule in PC design. But look around on an iMac for a few minutes—or better yet, sit down and use it—and you'll quickly discover the work left undone. The tiny, uncomfortable, anti-ergonomic mouse is the most obvious example, but elsewhere you'll find irritating trap doors, the infamous lack of a floppy disk drive, and more. Yep, it's living-room-pretty—but there's more to good design than translucent green plastic.

The new Apple PowerBook G3 notebook also gets a lot of press as an exemplar of good design. It's nearer the ideal than the iMac, and pretty well designed. I especially like its curviness and tactile finish, which are not only pleasing to the eye but also make the notebook an easier and safer carry. But it too has irritating little design flaws that could and should have been fixed before Apple started building it.

In the PC universe, we also have a lot of near misses. This year's hit subnotebooks, from Sharp, Sony, and Toshiba, each demonstrate the prevailing “bunch of good ideas not fully developed” syndrome.

All, for example, need better texturing or surface

finishes, to make them safer to carry. This is a general problem with notebooks. Ever since we lost the carrying handles common on early laptops, notebooks have gotten harder and more unsafe to carry. I recall seeing at least five “notebook drops” over the years, thanks to poor surfaces and a lack of handles.

And all have key-position issues. Yes, we can get used to almost anything, but we shouldn't have to.

In desktops, the first swipes at “designy” machines from Acer and others produced duds. Blasting a monitor case full of holes with a shotgun (or giving the appearance of having done so) isn't design, it's self-indulgence. Again, this was design for design's sake, pushing “aesthetics” without any attempt to integrate them into the device's *function*.

Today's desktops with intelligent mechanical designs, such as the now-aging Dell OptiPlex and the Toshiba Equium, won their stripes with easy, pop-top access, and sometimes relative ease of swapping internal components. But there's a lot more to good mechanical design than being able to get the lid off—ask any Beetle owner—and besides, both machines are ugly, especially the OptiPlex.

Other “looks” available today also fail the FF Test, few so egregiously as the latest Compaq Presarios, which are not only generally inconvenient to use but also profoundly unattractive. Two strikes and out.

The answer to better design in PCs doesn't lie in little robotlike machines or exotic aluminum cubes sitting atop squat tripods, such as Panda Project's Archistrat series or its newer Rock City models—though both are welcome explorations, if also less than ready for general markets. The answer lies in getting product and design people together early, which leads to such brilliantly realized designs as the early Macintosh PowerBook Duo.

When will that vision come to market?

Digicam Notebook. A few notes from the front in the rapidly changing digital camera world.

Some time ago, my colleague John C. Dvorak urged *PC Magazine* readers who use digicams to



The answer to better design in PCs doesn't lie in little robotlike machines or exotic aluminum cubes.

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Jim Seymour

search for rechargeable nickel hydride batteries for their digital cameras. These batteries are far better for high-drain applications such as digicams.

Nickel hydride cells, in the almost ubiquitous double-A size, have been essentially unavailable in the U.S. market, though they're widely used in Japan. They are starting to trickle into the U.S. now but are still tough to find. And they're rarely seen (here) carrying familiar labels.

I enthusiastically second John's recommendation. In a camera store some time ago, I found a four-pack of Quest double-A nickel hydrides, plus another four-pack bundled with a charger, for a total of about \$75, and they've made a huge difference in my use of digital cameras. I was burning \$4 packs of throw-away alkaline double-As at an alarming rate; now I get weeks of use from a set of Quest double-As. Tip: I've spotted the Quest batteries in many better-quality camera stores but have yet to see them from a computer outlet.

Also: Transferring images from the camera to your PC can be a real pain. The Sony Mavica digicam includes a 3.5-inch floppy disk drive, which is convenient, but the Mavicas are not, to put it gently, great cameras.

The USB links on newer digicams work well, once you get the kinks out of USB on your PC. (You'll be a lot happier with the superior USB support in Win 98 than with the jury-rigged Win 95 OSR2 half-answer.)

Another good solution for users of cameras that accept the soon-to-be-dominant CompactFlash "digital film" removable-storage devices: external CF readers from Lexar Media and Simple Technology. These parallel-port devices are compact, relatively fast, and a great choice for desktop PCs.

If you use a notebook or are among the few who've installed PC Card (a.k.a. PCMCIA) "drives" in their desktops, the very best way of transferring images is by popping your CompactFlash card into one of the inexpensive PC Card adapters available from Lexar and Simple, then inserting that "carrier" into your PC Card slot.

You'll get very fast, simple, reliable transfers. Hey—sounds like good design creeping in! **PC**

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Home Sweet Cyberhome

Avocations and hobbies, unchecked, can become fetishes. I believe we stopped in time. Barely. My fondest desire was to wire the house so we could communicate among PCs in different rooms, and so our AV system could talk to our PCs in the future when convergence becomes reality. We did this,

and it all works. We stopped before we installed remote-controlled drape-pullers or created a Jacuzzi we could fill by pressing buttons on the car phone.

Two years ago we began to remodel our house; we upgraded the kitchen, built a family room with a home theater, and added a separate home office. While the interior walls were open, we decided to put enough wiring in the walls to be ready for most anything that would happen in the computer or AV worlds in the next 20 years. It grew to encompass almost a mile of network, phone, coaxial, speaker, infrared, and alarm cabling.

On the computer side, we installed a structured wiring system—also called CEBus (Consumer Electronics Bus) wiring—in a dozen locations comprising two Category 5 unshielded twisted pair (UTP) wires for networking or phone service and two RG6 coaxial wires for distributing cable TV, cable modem, and satellite signals. The wiring all goes back to a central point in the house, a wiring hub (also called a wiring panel, patch panel, gateway, or wiring server) that handles phone, ISDN, DSS, cable modem, networking, and in some cases alarm wiring. Despite the name, the wiring hub is not a file server or a network hub. Ours was from U.S. Technologies (www.ustec.com), the most serious player when we started remodeling. Other players today include IBM, IES, Lucent, and Siemon. Figure \$1,000 for the box and \$100 to \$150 a room for the wiring and outlets.

Some of the neighbors were initially perplexed: Why should our 5-year-old and 8-year-old have 100-megabit Ethernet connections in their bedrooms? Because at some point in their lives they'll likely have their own PCs, but we'll still have only one cable modem or DSL connection to the Internet. Shared high-speed access to the Net is one thing structured wiring delivers.

The AV system has some network tie-ins (the cable modem and DSS feed both use the RG6 cabling) and will have more in the future. We actually built three AV systems: an all-out home theater in the family room, a more modest setup in the office

so I can watch a movie while working, and one for background music throughout the first floor and in the backyard. I wound up with an eclectic mix of equipment: Yamaha, Sony, NHT, Cambridge Sound Works, Bose, Niles, and Monster Cable.

When it works, it's delightful: a movie playing in one room, background music elsewhere in the house, and the ability to change music and adjust the volume with a tiny walk-around remote. But getting the various brands to work together can be a bear. Home AV really needs to get along better.

Other intelligence we learned along the way:

- Install a basement-to-attic conduit in two places in the house; if technology changes, you can snake new wires cheaply. We didn't install fiber-optic cabling because no one we talked to believes it will be vital in the house anytime soon. If we're wrong, the conduit is ready. We did install IEEE 1394 (FireWire) cabling (just the cable, no connectors), because it will be significant shortly.

- Audio purists may sniff, but the best way to get everything to work together is to buy one brand of AV equipment. Sony does the best job making the whole greater than the parts.

- If possible, try to find one installer who can handle home networking, alarm, and audio/video. Call the wiring hub manufacturers for leads on installers in your area. If you want the best video installation, look for someone who works (or used to) with two certifying groups: CEDIA (www.cedia.org) or PARA.

- If you're installing a new alarm, look for one that can hook to your PC in the future. Mount the panel next to your wiring hub.

When I started investigating this in 1997, no one suspected how quickly wireless (Home RF) and phone-line (HomePNA) networking would arrive. If your needs are file and Internet-connection sharing (rather than AV distribution), give phone networking a try first. But if you're building a new house or doing extensive remodeling, do it right and go for the industrial-strength solution. What's a small fetish among friends? 



We stopped before we installed remote-controlled drape-pullers or created a Jacuzzi we could fill by pressing buttons on the car phone.

More on the Web:

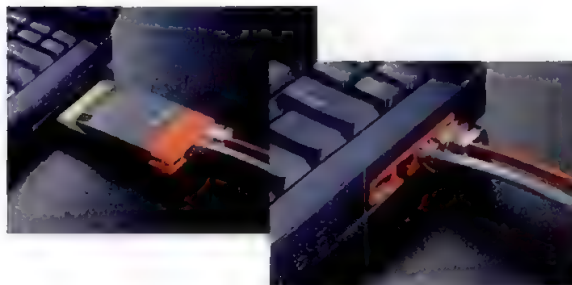
For more information and resources on home networking, see Bill Howard's expanded column online.

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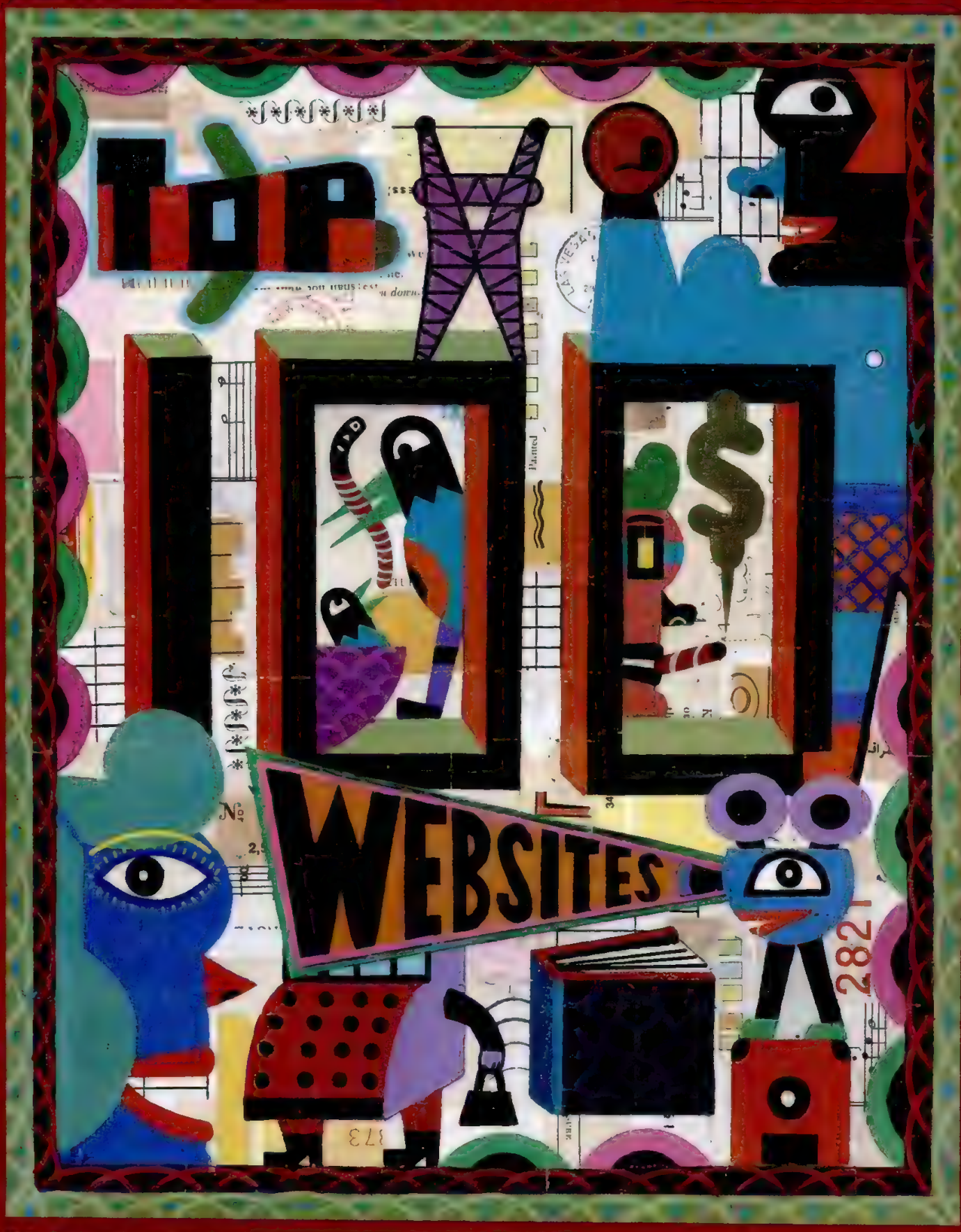
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Cover Story





HERE ARE THE BEST PLACES TO GO ONLINE TO LEARN, SHOP, WORK, RESEARCH, AND RELAX.

By Don Willmott

The Web continues its breathtaking growth and evolution, and PC Magazine's list of the top 100 sites, which we update four times a year at PC Magazine Online, has evolved, too.

In order to reflect all the ways the Web is infiltrating every aspect of our daily lives, we've expanded our list of categories from 5 to 20, and we've chosen our favorite 5 sites in each of those arenas. Our category list isn't comprehensive, of course, and as you might expect, it includes quite a few sections devoted to various aspects of computing.

The list does include Editors' Choice sites that we've named in our recent evaluations, but for the most part, it's a subjectively chosen selection, compiled with the help of more than a dozen PC Magazine editors who spend remarkable amounts of time working, playing, and living online. These are our essential bookmarks, the list of sites that we find ourselves returning to again and again for their ease of navigation, design, content, and most important of all, their usefulness.

Many Web sites make lots of promises and then fail to deliver. We think you'll agree that all the sites on our list live up to their stated intentions and do so with style.

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site is easily searchable, so you can find the types of things you're looking for among the 275,000 items that are typically for sale at any moment.

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Even at off-hours, it's possible to find more than 3,000 people hanging out at this large community, chatting in any of dozens of subject-related rooms or spending time in user-created non-real-time "communities"

that are organized into 21 main categories and dozens of sub-categories. There's definitely something for everyone.



ICQ.COM

www.icq.com

ICQ.com was just named one of the ugliest Web sites in the world, and

we heartily agree. Nevertheless, the tools it offers—namely, the downloads you need to chat privately online with your friends and colleagues all around the world—have caused one of the Web's biggest sensations. With 20 million subscribers and over five million unique users every day, ICQ is a huge success story. Visit here and find out why.



TALKCITY

www.talkcity.com

TalkCity has some of everything that makes a Web community great: more than one million members, 12 megabytes of home page space for each member, and plenty of forums on every imaginable topic. Where TalkCity distinguishes itself is in the number and scope of its scheduled chats. There are dozens every day; some meet regularly, and others are special one-time celebrity events.

TRIPOD

www.tripod.com

Tripod was one of the first online communities, and it's still one of the best, providing its two million mostly

college-age and twentysomething members with 14 categories of entertainment and chat, along with free space to build home pages and some great assistance on how to do it with the Homepage Studio.

YAHOO! CHAT

chat.yahoo.com

Yahoo's strength in chat services comes from all its affiliations. Chats are co-hosted by several magazines including *Time*, *Fortune*, *People*, and *Money*, and cable channels like TNT and Web sites like ZDNet are in the mix as well. The result is a schedule of star-studded chats, but there are plenty of chances to go off on your own and meet like-minded people in close to 150 chat rooms that cater to just about every possible special interest group. (Softbank, the majori-

FOOD & WINE CHAT

Peter Kaminsky and friends!

ty shareholder in the parent company of *PC Magazine*, is an investor in Yahoo!)

COMPUTER SHOPPING

BUY.COM

www.buy.com

Buy.com's computing store, one of five Buy.com stores currently online, is helpful right from the first screen; it offers a text-only version to help you speed through your shopping. Once you dive in, you'll find an easy-to-navigate site that consistently delivers excellent prices on hardware (in 13 categories) and software (10 categories). (Softbank, the majority shareholder in the parent company of *PC Magazine*, is an investor in Buy.com.)



named this online software superstore as the Editors' Choice ("Buy It on the Web," November 17, 1998). For the best prices in software, this is the place to check first. The categories are arranged for easy browsing, and each product in-

cludes a descriptive write-up. Some entries link to ZDNet reviews for an objective opinion. Chumbo is also on

the cutting edge of electronic software distribution.

COMPUTERS.COM

www.computers.com

This well-organized CNET site

delivers shopping referrals. You find what you want to buy and are then presented with a list of online locations where you can get it, along with the latest prices. Fortunately, you can sort the list by vendor, price, or other criteria to help speed the decision-making process. The site also links to CNET reviews whenever they are available.

KILLERAPP

www.killerapp.com

It's easy to keep up with the Joneses at KillerApp, because the site tells you what the Joneses are buying. Top 100 lists in major categories show you the most popular products, and you can read what others have said about each product and get the lowest available price all on one screen. Like Computers.com, KillerApp has sortable summaries of features, so you can zero in on the one product that meets your specific needs.

DELL COMPUTER

www.dell.com

Michael Dell expects his Web site to generate half of Dell's revenue within a few years. At \$6 million in sales per day and climbing, that doesn't seem so far-fetched. The



site is a natural extension of Dell's mail order roots. The services Dell provides its corporate customers are especially impressive. It will set up a private mini Web site for any company that wants to make bulk purchases quickly. No vendor has harnessed the power of the Web better than Dell.



NECX

www.necx.com

More than 25,000 computer shoppers a day stop by at NECX to look at 30,000 products from 1,100 manufacturers. A recent *PC Magazine* evaluation ("Buy It on the Web," November 17, 1998) named NECX as the Editors' Choice in this category, citing its great design and great prices.

COMPUTING COMPANIES

MACROMEDIA

www.macromedia.com

Macromedia has been an Internet innovator for years. Its authoring products and Web technologies, such as Flash and Shockwave, have made the Web a better-looking and more interactive place. Macromedia's site takes advantage of the company's own technologies to guide you through its products' features. This implementation helps you better understand the possibilities of animation and interactivity online.

MICROSOFT

www.microsoft.com

Microsoft has made a lot of noise online recently with the relaunch of MSN.com, but the company's corporate site also offers computer junkies a little bit of everything—actually, quite a bit of everything—and the site's repository is growing larger daily. You can learn all about the company's products, get corporate

CHUMBO

www.chumbo.com

A recent *PC Magazine* evaluation

Our Contributors: DON WILLMOTT is executive editor of *PC Magazine Online*.

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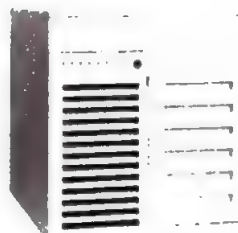
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about



and check out technology demos. You can also download free software, such as Internet Explorer 5.0.

REALNETWORKS

www.real.com

This site does a great job of promoting the company's RealPlayer technology and teaching developers how to use it. You can download everything you need, of course; you can

also view a gallery of Real implementations and head for the DevZone to see how to integrate streaming audio and video into your own site.



3COM

www.3com.com

3Com is a huge company with products in more than 35 categories, yet its site does a great job of getting you the information you need, be it about routers or modems. The best example probably is its coverage of Palm-based computing. Go to the affiliated site www.palm.com to find out anything you need to know about the 3Com PalmPilot or Palm III. 3Com has a lot to talk about, and this site does a great job of getting the messages across.

COMPUTING SITES

CNET

www.cnet.com

CNET has been undergoing something of a change recently as it morphs into a technology portal, but it's still a splashy, well-designed site rich with information on computing and on life in the digital age. Updated daily with breaking technology news, product reviews, and links to its four TV series, it's also the home of Shareware.com, a "virtual software library" where you can search through 250,000 shareware titles, and Download.com as well.



O'REILLY AND ASSOCIATES

www.oreilly.com

As home base for all the computing books that O'Reilly publishes, this site is something of a book catalog on steroids, because some of the books' contents are available for you to read for free. Resource centers on everything from Oracle to Perl list relevant books, offer links to sites you should see, and point to specific articles all around the Web.

WHATIS.COM

www.whatis.com

This straightforward site sets out to define every computer-related term clearly and concisely, and it succeeds. We like that and also the indispensable chart "The Speed Of...", which makes sense out of all the confusing data-rate terminology, as well as the shockingly long guide to all the file formats in the world.

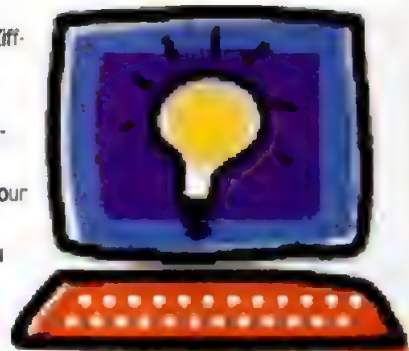


ZDNET

www.zdnet.com

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www.broadcast.com

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THE INTERNET MOVIE DATABASE

www.imdb.com

The IMDB, which is now owned by Amazon.com, is the single best film resource on the Web. With information on more than 170,000 movies, a 2.5 million-entry filmography, and listings of hundreds of thousands of actors, actresses, and crew members, you can search for almost anything and you won't be disappointed. A recent redesign has made

the site easier to use, and there are new columns to enjoy, including the gossip column "Scuttled Butts."

MP3.COM

www.mp3.com

The future of music on the Web is in the digital downloading of songs. The MP3 file format, which compresses CD-quality song files to manageable sizes, has caused a controversy, but despite the recording industry's copyright concerns, MP3 is an unstoppable trend. MP3.com is the place to get up to speed on what MP3 is, to download the software you need, and to learn how to digitize your CD collection and set up your own PC-based jukebox. Also at the site: 5 million legitimate song downloads.

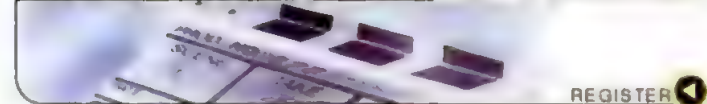


MYLAUNCH

www.mylaunch.com

A Web accompaniment to the CD-ROM-based magazine Launch, this music site delivers news, features, album and concert reviews, and chat. The unique aspect is the "my" part. By customizing the site, you can get much more information about the

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*Memory Research, data 1/1/98.
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www.theonion.com

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Madison, Wisconsin, but has found a worldwide audience online. The Onion's humor can be a little bawdy at times, but it's consistently one of the funniest places to visit online.

FAMILY/EDUCATION

ASK JEEVES FOR KIDS

www.ajkids.com

AJKids uses natural-language processing to accommodate plain-English Web search queries such as "Where can I learn about the brain?" The site will come back with a limited list of search results, all of which have been preapproved as appropriate for children. Teachers will find the site to be a great classroom resource; there's even a teachers' guide with suggestions on how to integrate AJKids into the curriculum.



learn more about the world of science.

FAMILY.COM

www.family.disney.com

Family.com, which is owned by Disney, is one of the Web's best jumping-off points for all things family-related online. You'll find information on parenting, education, travel, and activities, and you can scan the directory of

states to get links to family-related Web sites in your own neighborhood. There are also plenty of opportunities to buy Disney merchandise, too, but you can easily avoid the shopping parts of the site and focus on the great information it provides.

THE DISCOVERY CHANNEL

www.discovery.com

Producers at The Discovery Channel put as much effort into their Web site as into their TV shows, and the results are apparent. Parents and teachers should steer children to the site's seemingly limitless collection of feature stories, expeditions, mind games, and even "animal cams" that

are keeping an eye on sharks, orangutans, and Keiko the killer whale in his new Icelandic home. The site also features a daily audio news brief. Tune in and

NATIONAL GEOGRAPHIC

www.nationalgeographic.com

There's something for everyone in the family at this well-designed site, including highlights from the magazine *Traveler* and the kids' magazine *World*. You'll also find surveys, atlases, and print-



able maps. And whatever you do, don't miss *Xpeditions*—a stunning series of interactive geography lessons that bring maps to life in amazing ways. You won't find anything else like it online.

FINANCE/INVESTING

E*TRADE

www.etrade.com

E*Trade does a lot of business and does it all online, with more than 50,000 accounts and close to \$3 billion in customer assets. This leading Internet trading firm gets its edge from low commissions: Its \$14.95 to \$19.95 per-trade fee competes aggressively with others. E*Trade makes online investment decisions easy, too. With just a few clicks, you can buy and sell, manage your portfolios, and personalize news and market snapshots. If it has its way, E*Trade will make your broker obsolete. (Softbank, the

care of your pennies. (Premium features cost \$9.95 per month.)

QUICKEN.COM

www.quicken.com

This personal finance site offers the most comprehensive set of interactive tools to help you with your insurance, home-loan, tax-preparation, investment, and retirement-planning needs. Quicken.com takes an approach that starts at the beginning of your decision-making process. When you're evaluating insurance, you

can start by figuring out which type is best for you. When you're buying a home, you first calculate what your budget will allow. Quicken.com then distinguishes itself



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by following through and helping you complete a loan prequalification worksheet or get a price quote on a life insurance policy.

MSN MONEY CENTRAL

www.moneycentral.msn.com

Although it's among the newest of the personal finance sites, Money Central is off to a great start—in part because it includes MSN investor, which already has a good track record online. You can get free real-time stock quotes here and use stock and fund research wizards to guide you through the ins and outs of investing. There's also a daily Top Funds report, and a great-looking portfolio tracker with elegant charting. This is a fantastic site for taking

THE STREET.COM

www.thestreet.com

TheStreet.com is a Wall Street-savvy online financial information site that's produced by an A-list of financial journalists. Some features of the site, including its highly praised daily market analysis and real-time stock ticker, are free. Others are open only to members, who can join at either of two levels—\$70 per year or \$100 per year—to get a variety of extra services, including newsletters and

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- 40X Max™ Variable CD-ROM Drive
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DELL DIMENSION XPS R450 PENTIUM II PROCESSOR AT 450MHz

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- 8.4GB Ultra ATA Hard Drive
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\$1999

Business Lease[®]: \$76/Mo., 36 Mos.

 **E-VALUE CODE: 04016-590119**

DELL DIMENSION XPS R400 PENTIUM II PROCESSOR AT 400MHz

- 96MB 100MHz SDRAM
- 512KB Integrated L2 Cache
- NEW 12.9GB Ultra ATA Hard Drive
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- 40X Max™ Variable CD-ROM Drive
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- MS IntelliMouse
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DELL DIMENSION V350 PENTIUM II PROCESSOR AT 350MHz

- 64MB 100MHz SDRAM
- 512KB Integrated L2 Cache
- 8.4GB Ultra ATA Hard Drive
- 17" (15.9" viewable) 1000LS Monitor
- 8MB ATI 3D AGP Graphics
- 40X Max™ Variable CD-ROM Drive
- Yamaha XG 64V Wavetable Sound
- harman/kardon HK-195 Speakers
- 3Com USRobotics V.90® PCI Telephony WinModem
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- Iomega Zip 100MB Internal Drive with One Cartridge
- Logitech First Mouse+ Wheel (PS/2v)

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- 32X Max™ Variable CD-ROM Drive
- Integrated Intel 10/100 Ethernet Controller
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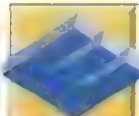
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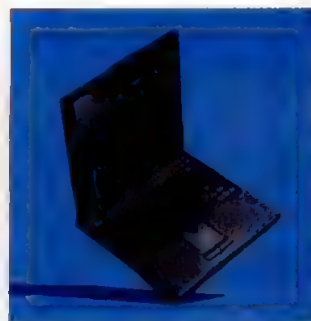
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- 2X AGP 8MB ATI RAGE Pro 3D Video
- 3D Surround Sound and Hardware Wavetable
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- Removable Combo 24X Max™ Variable CD-ROM and Floppy Drive
- 2X AGP 4MB ATI RAGE Pro 3D Video
- 3D Surround Sound and Hardware Wavetable
- 12-Cell Intelligent Lithium Ion Battery
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Business Lease*: \$102/Mo., 36 Mos.

 **E-VALUE CODE: 04017-890126**

DELL INSPIRON 3500 D266GT PENTIUM II PROCESSOR AT 266MHz FEATURING MMX TECHNOLOGY

Light Weight, Light Price

- 14.1" XGA Active Matrix Display
- 32MB SDRAM (256MB Max)
- 4.3GB Ultra ATA Hard Drive
- Modular 24X Max™ Variable CD-ROM
- Modular Floppy Drive
- NeoMagic MediaMagic 256AV AGP Video
- 3D Surround Sound and Software Wavetable
- 9-Cell Intelligent Lithium Ion Battery
- APC SurgeArrest Notebook Pro
- MS Office 97 SBE (Call about Our FREE MS Office 2000 Upgrade Offer)
- Microsoft Windows 98/Touchpad
- 3-Year Limited Warranty†

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Business Lease*: \$90/Mo., 36 Mos.

 **E-VALUE CODE: 04017-890123a**

DELL INSPIRON 3500 D233XT PENTIUM II PROCESSOR AT 233MHz FEATURING MMX TECHNOLOGY

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- 13.3" XGA Active Matrix Display
- 32MB SDRAM (256MB Max)
- 3.2GB Ultra ATA Hard Drive
- Modular 24X Max™ Variable CD-ROM
- Modular Floppy Drive
- NeoMagic MediaMagic 256AV AGP Video
- 3D Surround Sound and Software Wavetable
- 9-Cell Intelligent Lithium Ion Battery
- MS Office 97 SBE (Call about Our FREE MS Office 2000 Upgrade Offer)
- Microsoft Windows 98/Touchpad
- 3-Year Limited Warranty†

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Business Lease*: \$76/Mo., 36 Mos.

 **E-VALUE CODE: 04017-890119**

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Network-Optimized Notebook

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- 96MB EDO RAM (256MB Max)
- 4GB Ultra ATA Hard Drive
- Modular 24X Max™ Variable CD-ROM
- Modular Floppy Drive
- NeoMagic 128-bit Graphics Accelerator
- 3D Surround Sound and Software Wavetable
- Intelligent Lithium Ion Battery with ExpressCharge™ Technology
- MS Windows NT® Workstation 4.0
- Touchpad
- 3-Year Limited Warranty†
- 1-Year NBD On-site^A Service

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Business Lease*: \$114/Mo., 36 Mos.

 **E-VALUE CODE: 04017-790129**

DELL LATITUDE CP M233ST PENTIUM PROCESSOR WITH MMX TECHNOLOGY AT 233MHz

Network-Optimized Notebook

- 12.1" SVGA Active Matrix Display
- 32MB EDO RAM (128MB Max)
- 4GB Ultra ATA Hard Drive
- Modular 20X Max™ Variable CD-ROM
- Modular Floppy Drive
- NeoMagic 128-bit Graphics Accelerator
- 3D Surround Sound and Software Wavetable
- Intelligent Lithium Ion Battery with ExpressCharge Technology
- MS Windows NT Workstation 4.0
- Touchpad
- 3-Year Limited Warranty†
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\$2199

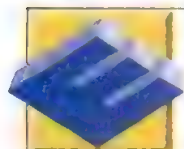
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DELL NOTEBOOK AWARD INFO™

- Two-time "A" rating in PC Magazine's Readers' Choice Awards for Service and Reliability.
- Latitude Line – PC Computing's "Best Overall" Rating Three Years.
- Inspiron 7000 D300GT – CNET Editors' Choice.

Advertised configurations vary from (new) naming configurations.



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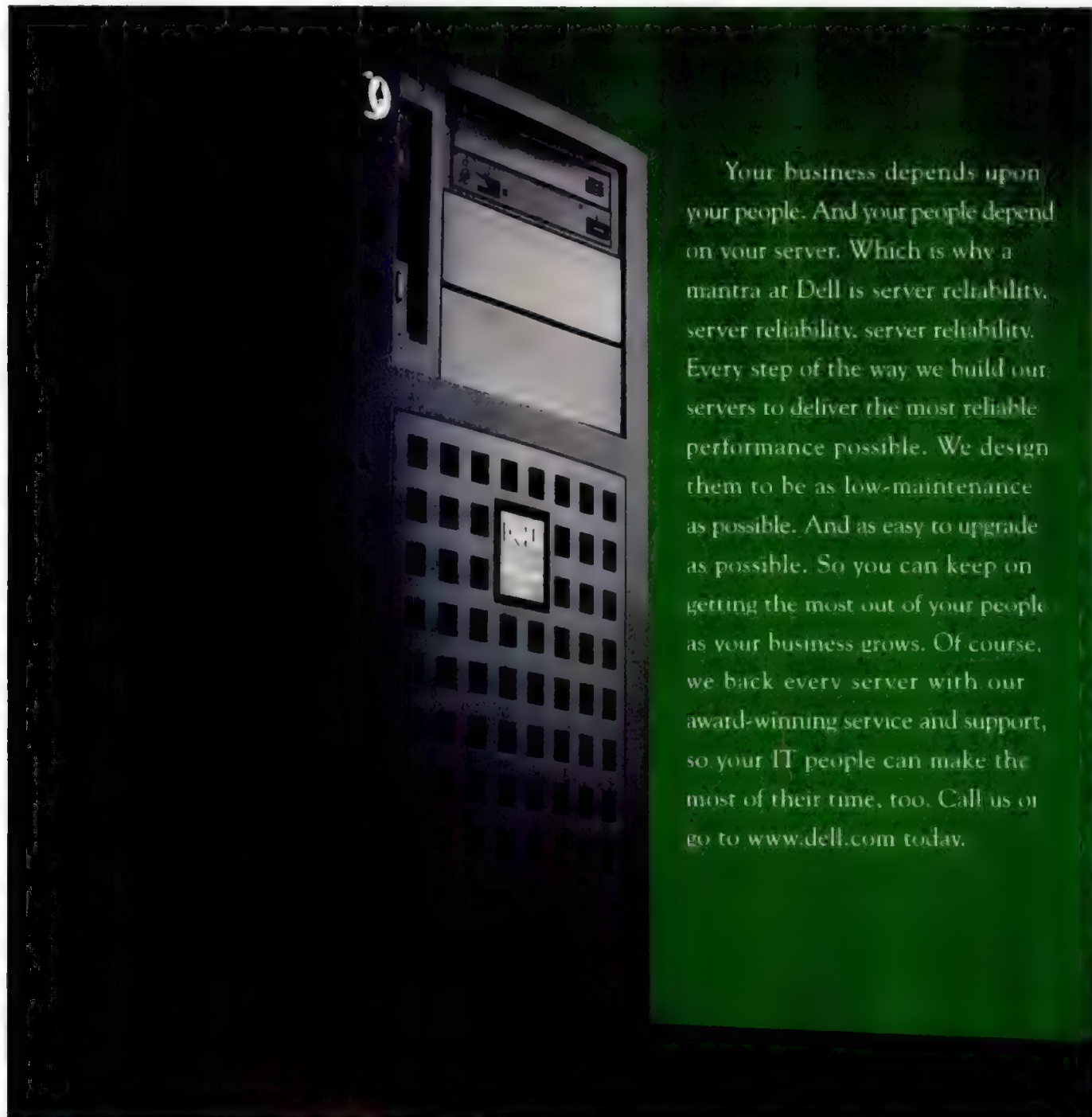
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DELL POWEREDGE 2300 SERVER PENTIUM® II PROCESSOR AT 350MHz (DUAL PROCESSOR/RAID CAPABLE)

- 64MB 100MHz ECC SDRAM
- 512KB Integrated L2 ECC Cache
- 4GB Ultra-2/LVD SCSI Hard Drive (Hot-Swap Optional)
- 32X Max* Variable SCSI CD-ROM Drive
- HP OpenView™ NNM Special Edition
- Intel® Pro/100+ PCI Ethernet Adapter
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
- 4-1.6" or 6-1" Hard Drive Bays
- 3 External 5.25" Drive Bays plus Dedicated 3.5" Floppy Drive Bay
- 3-Year NBD On-site* Service
- 7x24 Dedicated Server Hardware Technical Telephone Support
- ★ Upgrade to a Pentium II Processor at 400MHz, add \$300

\$2449

Business Lease*: \$93/Mo., 36 Mos.

 **E-VALUE CODE: 04018-290124**

DELL POWEREDGE 2300 SERVER PENTIUM II PROCESSOR AT 400MHz (DUAL PROCESSOR/RAID CAPABLE)

- 128MB 100MHz ECC SDRAM
- 512KB Integrated L2 ECC Cache
- 9GB Ultra-2/LVD SCSI Hard Drive (Hot-Swap Optional)
- 32X Max* Variable SCSI CD-ROM Drive
- Microsoft® Windows NT® Server 4.0 (10 Client Access Licenses)
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
- 4-1.6" or 6-1" Hard Drive Bays
- 3 External 5.25" Drive Bays plus Dedicated 3.5" Floppy Drive Bay
- 3-Year NBD On-site* Service
- 7x24 Dedicated Server Hardware Technical Telephone Support

\$3999

Business Lease*: \$151/Mo., 36 Mos.

 **E-VALUE CODE: 04018-290139**

DELL POWEREDGE 2300 SERVER PENTIUM II PROCESSOR AT 450MHz (RAID 5 CONFIGURATION)

- 128MB 100MHz ECC SDRAM
- 512KB Integrated L2 ECC Cache
- Three 9GB Ultra-2/LVD SCSI Hot-Swap Hard Drives
- Ultra-2/LVD PowerEdge Expandable RAID Controller 2/SC
- 32X Max* Variable SCSI CD-ROM Drive
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
- 6-1" Hard Drive Bays
- 3 External 5.25" Drive Bays plus Dedicated 3.5" Floppy Drive Bay
- 3-Year NBD On-site* Service
- 7x24 Dedicated Server Hardware Technical Telephone Support

\$5499

Business Lease*: \$202/Mo., 36 Mos.

 **E-VALUE CODE: 04018-290154**

NEW DELL POWEREDGE 4300 SERVER PENTIUM II PROCESSOR AT 450MHz (DUAL PROCESSOR/RAID CAPABLE)

- 128MB 100MHz ECC SDRAM
- 512KB Integrated L2 ECC Cache
- 18GB Ultra-2/LVD SCSI Hard Drive (Hot-Swap Optional)
- 32X Max* Variable SCSI CD-ROM Drive
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- Redundant Hot-Swap Power Supplies, Cooling Fans and Processor Fans
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
- 10 Bays: 6 Drive Bays, 4 Media Bays
- 3-Year NBD On-site* Service
- 1-Year DirectLine™ Network Operating System Support
- 7x24 Dedicated Server Hardware Technical Telephone Support

\$5999

Business Lease*: \$220/Mo., 36 Mos.

 **E-VALUE CODE: 04018-290159**

NEW DELL POWEREDGE 4300 SERVER DUAL PENTIUM II PROCESSORS AT 350MHz (DUAL PROCESSOR/RAID 5 CONFIGURATION)

- 128MB 100MHz ECC SDRAM
- 512KB Integrated L2 ECC Cache
- Three 9GB Ultra-2/LVD SCSI Hot-Swap Hard Drives
- Ultra-2/LVD PowerEdge Expandable RAID Controller 2/SC
- 32X Max* Variable SCSI CD-ROM Drive
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- Redundant Hot-Swap Power Supplies, Cooling Fans and Processor Fans
- 6 Expansion Slots: 4 PCI, 2 PCI/ISA
- 10 Bays: 6 Drive Bays, 4 Media Bays
- 3-Year NBD On-site* Service
- 1-Year DirectLine NOS Support
- 7x24 Dedicated Server Hardware Technical Telephone Support

\$7449

Business Lease*: \$270/Mo., 36 Mos.

 **E-VALUE CODE: 04018-290174**

DELL POWEREDGE 6300 SERVER PENTIUM® III XEON™ PROCESSOR AT 400MHz (QUAD PROCESSOR CAPABLE)

- 128MB ECC EDO Memory
- 512KB Integrated L2 Cache/Processor
- Three 9GB Ultra-2/LVD SCSI Hot-Swap Hard Drives
- Ultra-High Performance 64-bit Ultra-2/LVD PowerEdge Expandable RAID Controller 2
- 32X Max* Variable SCSI CD-ROM Drive
- HP OpenView NNM Special Edition
- Intel Pro/100+ PCI Ethernet Adapter
- Integrated Dual Ultra-2/LVD and Ultra/Narrow SCSI Controllers
- Redundant Hot-Swap Power Supplies, Cooling Fans and Processor Fans
- 7 Expansion Slots: 4x64-bit, 3x32-bit
- 10 Bays: 6 Drive Bays, 4 Media Bays
- 3-Year NBD On-site* Service
- 1-Year DirectLine NOS Support
- 7x24 Dedicated Server Hardware Technical Telephone Support

\$11,899

Business Lease*: \$421/Mo., 36 Mos.

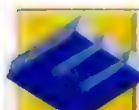
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DELL SERVER AWARD INFO¹

- *Network World* "World Class Award" for flexibility, serviceability and manageability – Dell PowerEdge 2300.
- *Computer Shopper* "Top 100" – Dell PowerEdge 2300.
- *PC Computing's* "The 'A' List" – Dell PowerEdge 6300.

Advertised configurations vary from award-winning configurations



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DELL PRECISION™ WORKSTATION 610 NEW PENTIUM® II XEON™ PROCESSOR AT 450MHz (DUAL PROCESSOR/RAID CAPABLE)

- 128MB 100MHz ECC SDRAM
- 512KB Full-Speed Integrated L2 Cache
- 9GB Ultra-2/LVD SCSI Hard Drive
- 21" (19.8" viewable, .26dp) Trinitron® 1600HS Monitor
- 3Dlabs Oxygen GMX 2000 Graphics Card
- 40X Max™ Variable CD-ROM Drive
- Sound Blaster Pro Compatible Sound
- 3Com® 10/100 PCI NIC
- Remote Client Manageability Support via DMI 2.0; Wakeup on LAN Capable
- **MS® Windows NT® 4.0 and 1-Year NT Telephone Support**
- 3-Year NBD On-site^A Service
- 7x24 Dedicated Workstation Hardware Telephone and Online Technical Support

\$5979

Business Lease^B: \$220/Mo., 36 Mos.

E-VALUE CODE: 04019-490159

DELL PRECISION WORKSTATION 410 PENTIUM II PROCESSOR AT 400MHz (DUAL PROCESSOR/RAID CAPABLE)

- 128MB 100MHz ECC SDRAM
- 512KB Integrated L2 Cache
- 4GB Ultra-2/LVD SCSI Hard Drive
- 17" (15.9" viewable) 1000LS Monitor
- Diamond 8MB AGP Graphics Card
- 40X Max™ Variable CD-ROM Drive
- Sound Blaster Pro Compatible Sound
- harman/kardon HK-195 Speakers
- 3Com 10/100 PCI NIC
- Remote Client Manageability Support via DMI 2.0; Wakeup on LAN Capable
- **MS Windows NT 4.0 and 1-Year NT Telephone Support**
- 3-Year NBD On-site^A Service
- 7x24 Dedicated Workstation Hardware Telephone and Online Technical Support

\$2999

Business Lease^B: \$114/Mo., 36 Mos.

E-VALUE CODE: 04019-490129



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- MS Office 2000 Professional Edition
- Telephone Support
- 3-Year NBD On-site Service
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Business Lease* \$83/Mo., 36 Mos

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4 BUILD THIS

CUSTOM CONFIGURE YOUR SYSTEM

2 component selections may require changes to other system options. Please check below.

Dell Dimension XPS R MiniTower
Pentium® III processor 450 MHz with 512KB L2 cache

Memory
128MB SDRAM

Hard Drive
14.4GB LTR AATA Hard Drive (7200 RPM)

Monitor
21" (19.8" viewable, 26dp Triflex® 1500HS Monitor [add \$53])

Video Card
NEW 16MB STB nVidia TNT 3D AGP Graphics Card

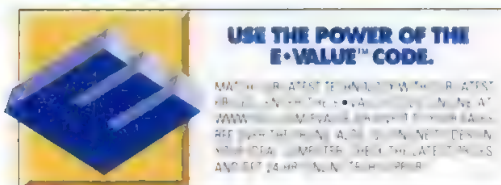
DVD-ROM or CD-ROM Drive
48X DVD ROM Drive and Decoder Card

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deeper analyses of individual companies and funds. This is as good as financial journalism gets online.

YAHOO! FINANCE

www.quote.yahoo.com

Like everything else Yahoo! creates online, Yahoo! Finance is a stripped-

very interactive and very cool Java-based version) is accompanied by current news headlines relating to the stocks you watch. And a portal-style directory highlights the best of the Web's financial resources, including Yahoo's own finance discussion boards and chats. (Soft-

down, no-nonsense site committed to delivering the information you want quickly. Your portfolio (with a

bank, the majority shareholder in the parent company of *PC Magazine*, is an investor in Yahoo!)

GAMING

GAMECENTER.COM

www.gamecenter.com

This CNET-based site shares many features with the rival Gamespot, having a strong emphasis on game downloads and game cheats/guides.

PlayStation, or online gaming. IGN is a good source of information. Internet-based play is included via the World Opponent Network, and the site has a strong collection of cheats and codes.

MSN GAMING ZONE

www.zone.com

On a recent weekday morning, we found almost 8,000 people playing games live on the Web at the MSN

A nice feature here is the portal-like design of the site, which makes it easy to drill down into the areas that interest you most.

GAMESPOT

www.gamespot.com

Gamespot, a ZDNet site, is a great one-stop resource for gaming news, previews, reviews, demos, and downloads. Affiliated with the magazine *Computer Gaming World*, the site has a reputation for being first with the hottest new toys. Another feature we especially like: Designer Diaries, where you get to go inside the sometimes warped minds of the people who create all those crazy games. (ZDNet is a property of Ziff-Davis, the publisher of *PC Magazine*.)

IGN.COM

www.ign.com

Whether you're into PC, Nintendo,

Gaming Zone. Most were playing board games like backgammon or card games like spades, but there was a big contingent in the Age of Empires section, and Fighter Ace (one of the fee-based games available) was popular, too.



KILL
or Be Killed

UPROAR.COM

www.uproar.com

Uproar.com bills itself as "online entertainment for really smart people." Bingo

Blitz, Picture This, and Puzzle-a-Go-Go are but a few of the gameshow-style games you can play at this popular site. Register to play and you can pick up some cash and prizes as you match wits with hundreds of other users, or head to GameScene to play more traditional board and strategy games.

NEWS

ABCNEWS.COM

www.abcnews.com

ABC News scrolls the headlines, offers special online-only features from international correspondents, and delivers just the right amount of video to accentuate the latest-breaking stories. Instant polls pop up often, and links to all of ABC News' shows keep you updated on future topics. Dig one level deep into the site's sections and you'll be surprised by the quantity of news and information you'll find.

CNN INTERACTIVE

www.cnn.com

CNN Interactive fills in all the angles online with multimedia galleries, in-depth analysis, polls, and searchable background material. The site's talent for providing related links is unsurpassed. One of CNN's finest features is Video Select, which provides clips of late-breaking news within minutes. You also have the option of setting up your own personal CNN Custom News page. CNNfn, CNN's financial news network, is equally up to the minute and offers expert opinions on every monetary matter.

MSNBC

www.msnbc.com

MSNBC is the most interactive of all the news sites. It is closely allied with MSNBC on TV and all the chatting that goes on there. The site complements its TV counterpart in interesting ways: When you view an MSNBC piece on hazardous waste, you can go to the



Web site to see whether you have such waste in your neighborhood. There's also a personalized news page that delivers a custom page to your screen. MSNBC is way ahead of ABC and CNN when it comes to polls, chats, and discussions. This expansive site makes news make sense.

THE NEW YORK TIMES

www.nytimes.com

Frequent re-designs guarantee that *The New York Times*'s site remains one of the Web's most stylish news sites. Most of the day's paper is available online, as are archives including more than 50,000 book reviews. Tech heads will appreciate the excellent CyberTimes section, which includes the paper's coverage of high-tech issues as well as online-only reportage about computing.

THE WIRE

www.wire.ap.org

No nonsense here. The Wire is your most direct access to current news stories and photographs coming across the Associated Press wire. If you live in a city with an affiliated newspaper, you'll see the news in that paper's format. There are many places to get news online, but for



some kinds of news, this is as close to the source as you can get.

PEOPLE FINDERS

ANYWHO

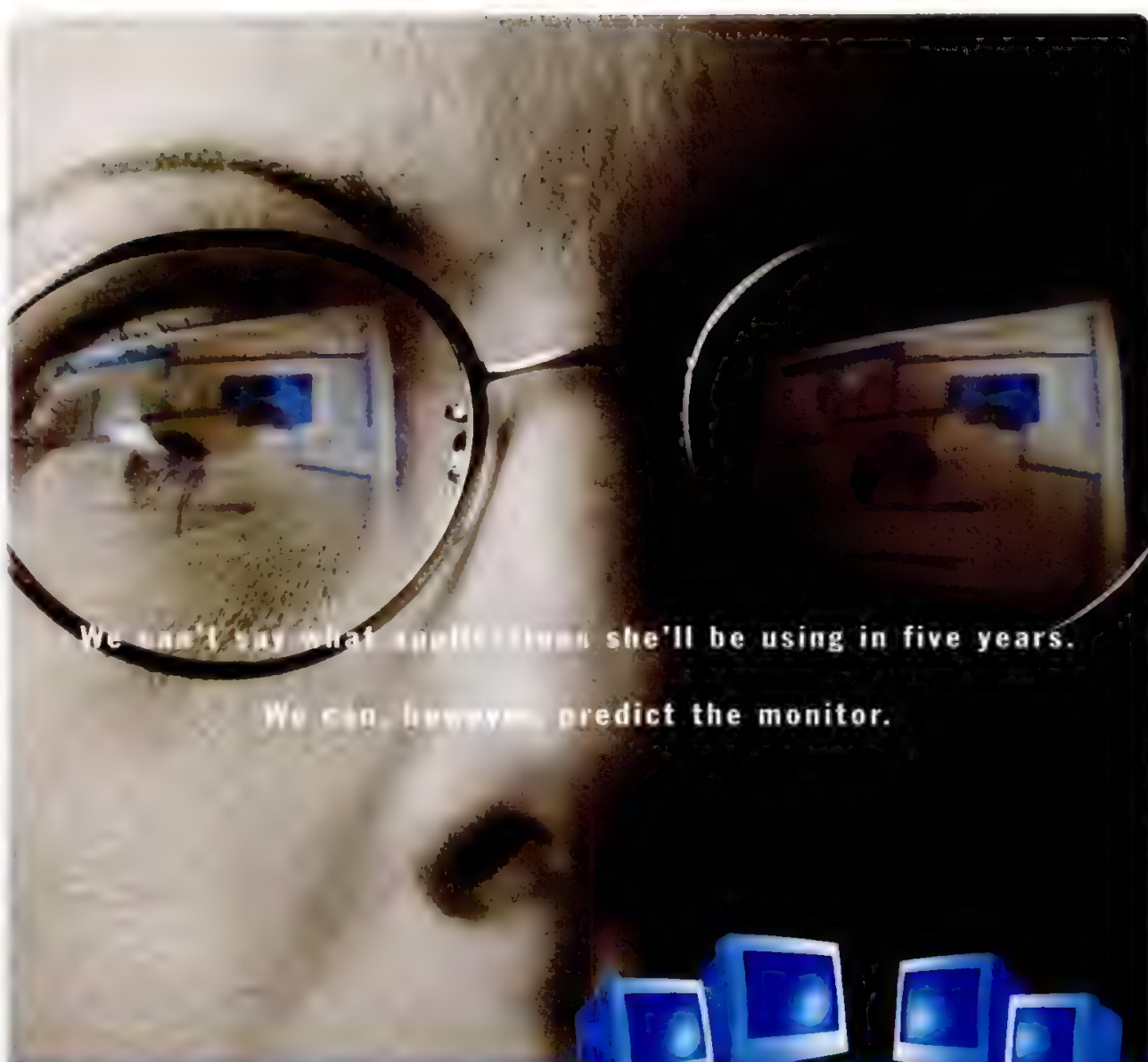
www.anywho.com

AnyWho has the same complement of features as many other look-up services, but this site, which was created by the Internet Directory Group of AT&T Labs, also lets any business promote its Web pres-

ence and its real-world presence in a single directory listing. Though such a feature may not be of the utmost importance today, it's definitely pointing in the right direction, as more people do more product research and shopping online.

Book Review





We can't say what applications she'll be using in five years.

We can, however, predict the monitor.



MultiSync

Software goes out of date. CPUs are superseded.

OUR NEW SHORT-DEPTH MULTISYNC E750 COMPLETED THE E SERIES FAMILY.

In the face of nearly chaotic change, it's reassuring to know you can count on MultiSync® E Series monitors for years to come. Take a look. Our ChromaClear™ and dot trio CRTs deliver all the contrast, sharpness and color-saturation you need for demanding applications. But what isn't so apparent is the reliability and flexibility we build into each monitor. Refresh rates up to 120 Hz, PC and Macintosh compatibility and

	MultiSync E500™	MultiSync E750™	MultiSync E900™	MultiSync E1100™
Viewable Image Area	13.5"	16.0"	18.0"	19.5"
CRT	ChromaClear™	Short-depth ChromaClear	Microfilter™ Dot Trio	Microfilter™ Dot Trio
Dot Pitch	0.25mm mono	0.25mm mono	0.26mm dot 0.22mm horizontal	0.28mm dot 0.24mm horizontal
Maximum Resolution	1280 x 1024 @ 65Hz	1600 x 1200 @ 73Hz	1600 x 1200 @ 77Hz	1600 x 1200 @ 77Hz

the optional IntelliBase™ Series™ monitor bases mean they'll grow as your needs change. And for added security, they're backed by a three-year warranty. MultiSync E Series monitors. With longevity like this, you might just retire before your monitors do.

NEC

IntelliBase
Intelligent 3D and audio solutions



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SWITCHBOARD

www.switchboard.com



The Switchboard directory and people finder provides 106 million residential listings and 11 million business listings. You can

also search for a business using its distance from you as a criterion. And you can take advantage of a unique "knock-knock" feature, which is like Caller ID for e-mail.

WHOWHERE

www.whowhere.lycos.com

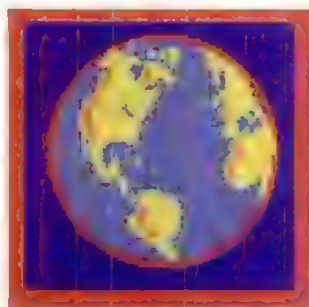
WhoWhere, now part of The Lycos Network, distinguishes itself from other people finders with lots of additional features, including a personal home page directory that you can search using topics of interest, community finders, genealogical queries, and maps.

WORLD PAGES

www.worldpages.com

Here's yet another great directory of directories to add to your reference bookmarks. You'll find 112

million U.S. and Canadian white- and yellow-pages listings, 9 million e-mail addresses, 30 million URLs, and links to over 200 directories. Most listings are accompanied with map makers to help you see where the results of your people or service searches are located.



YAHOO! PEOPLE

www.people.yahoo.com

Compared with other people finders, Yahoo! People, which was formerly Four11, is surprisingly underpowered, with none of the advanced features its competitors have. Fortunately, it does an excellent job at the tricky task of searching for e-mail addresses, and that redeems it for the time being.

(Softbank, the majority shareholder in the parent company of *PC Magazine*, is an investor in Yahoo!)

previous attempts to build a successful online presence for the general public. This clean portal-style site is completely customizable, and it provides one-click access to all of Microsoft's other online efforts, many of which are mentioned elsewhere in this story. And it's the only portal with its own built-in encyclopedia, the popular Encarta.



NETSCAPE NETCENTER

www.home.netscape.com

Click the N button on your Netscape browser and you'll arrive at Netcenter. This portal, which is tightly integrated with Netscape browsers' Smart Browsing, includes many first-level subsections that are heavily edited to help you find what you're looking for. Type in "books," for example, and you'll get an entire sub-portal devoted to the topic. Netscape is frantically making deals to improve the quality of the portal; for example, the Celebrities section is sponsored by "Entertainment Tonight." Netscape

browser users, in particular, will easily see how good this portal is.

YAHOO!

www.yahoo.com

Yahoo! has evolved into such an effective Web portal that it's a natural for inclusion on our list. Beyond its excellent categorization of the Web, Microsoft's Yahoo! has built a real community online.

Your first stop should be at My Yahoo!, where you can set up your own personal page for news headlines of interest, stock quotes, and even horoscopes. You should also check out the local Yahoos for major cities, and stop off at Yahoo! Chat to share your views. The kids will get a kick out of Yahoo!igans! listings, and the site has classified ads to browse. New to the site: Yahoo! Clubs that let you set up private meeting places for friends, family, and organizations. (Softbank, the majority shareholder in the parent company of *PC Magazine*, is an investor in Yahoo!)

PORTALS/START PAGES

EXCITE

www.excite.com

Excite was the Editors' Choice in *PC Magazine's* September 1, 1998, evaluation of Web portals, and that honor earns it a place on this list as well. Like Yahoo!, Excite is quickly evolving into a full-service portal, and its extra features—chat, messaging, mail, and the like—share a look and feel that gives the whole site coherence.



for particular categories and keep them cataloged and up to date? At The Mining Company, you can suggest a category. If you become its official guide, you'll get paid for your trouble—depending, of course, on how much traffic you generate. So far, there are more than 500 guides in about a dozen top-level categories. You'll find everything from Chicago Theater to Visual Basic.

THE MINING COMPANY

www.miningco.com

Here's a novel approach to indexing and cataloging the best of the Web: Why not ask real human beings with real expertise to take responsibility

MSN.COM

www.home.microsoft.com

Goodbye and good riddance to the old Microsoft Network. Online since September, the new MSN.com finally makes sense of all of Microsoft's

BIGBOOK

www.bigbook.com

Are your fingers tired of doing the walking? BigBook helps them find a service in a snap. This comprehensive collection of over 16 million U.S. businesses lets you find specific services anywhere in the country. BigBook also gives you nationwide street maps, third-party reviews, and customer ratings of businesses with which you might be unfamiliar—features you definitely won't find in your dog-eared yellow pages. In addition, you can build a personal phone book for easy access to frequently called numbers.



INFOSPACE.COM

www.infospace.com

InfoSpace.com gathers up as much reference material as it can and then presents it in a portallike interface that guides you to yellow and white

pages, classifieds, maps and directions, shopping, financial information, TV listings, and a whole lot more.

INTERNAL REVENUE SERVICE

www.irs.gov

The IRS was one of the first government agencies to show up on our Top 100 list, and it makes a return visit, because its site has continued to improve over the years. The main thing here, of course, is tax forms. If the IRS prints it, you can get it, usually in PDF format, so you can print it out at home. No more annoying trips to the library or post office. You can even fill in your forms on-screen and print out your finished work. Also available: tons of tax advice written in a style that's easily understandable—and almost fun.

THE LIBRARY OF CONGRESS

www.loc.gov

We've raved about The Library of

EVENTUALLY EVERY BUSINESS graduates TO SCSI.



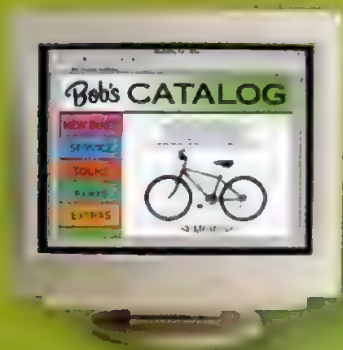
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The startup years. 0 MegaBytes.



The inventory years. 34 MegaBytes.



The global years. 156 MegaBytes.

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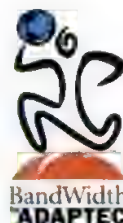
Over the course of your career, your electronic files grow. And grow. Until eventually, a hard drive and a floppy drive simply can't handle your biggest ideas. You need more options. More ways to access, distribute, and protect your work. You need SCSI options.

With a SCSI card in your PC, you can connect to a wide variety of high-capacity, high-performance storage devices. Only SCSI lets you choose internal or external Jaz™ drives, CD recordables, DVD, and the fastest hard drives available.

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Congress for years, and it just keeps getting better. Visit the site to take off on an exploration of the incredible American Memory online exhibits. Search Thomas for the full



text of all pending legislation. Or use any of dozens of research tools provided for your entertainment. The LOC is a real desert-island Web site, the kind of place that could occupy you for months if you had the time.

U.S. CENSUS BUREAU

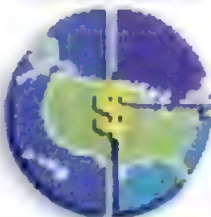
www.census.gov
Your tax dollars—and the tax dollars of 270 million or so other

citizens—are hard at work at the Census Bureau, where activity is gearing up for the year 2000 census. In the meantime, you can explore the vast amounts of fascinating data at this site to learn more about your town, county, or state by searching for just about any slice of the demographic pie that interests you. Economic indicators are available, too. There's even a "just for fun" section to introduce you to some of the off-the-wall types of information that the Bureau collects.

Current U.S. Population Count



Current Economic Indicators



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ALTAVISTA

www.av.com
AltaVista is still the best brute-force Web search engine, but these days it's putting on a prettier face. A redesign last fall brought many more features, including a fascinating Photo Finder, which helps you search for images on the Web, and a Family Filter to keep your searching clean. The search engine has also gotten much better at answering plain-English queries such as "Where can I find a map of Ethiopia?"

GOOGLE!

www.google.stanford.edu.com
Here's your chance to search the Web and participate in high-level academic research at the same time. Google! is a Stanford University project designed to find the most relevant Web pages (those with the

most related links) and run searches against them. The 25 million pages currently cataloged seem to be good choices; the site has an uncanny knack for returning extremely relevant results.

HOTBOT

www.hotbot.com
HotBot is now part of The Lycos Network, but its new home hasn't changed its purpose or functionality. Users turn to it for fast, accurate searches that return results sorted by relevance. Special features abound. You can search within a specified date range, and you can do a second search against the results of your first search. Searches in specific areas such as sports and entertainment are powered by specialty sites that have made deals with HotBot. The result: better search returns.

METACRAWLER

www.metacrawler.com
A part of the fledgling Go2Net network, MetaCrawler takes your search request and runs it against AltaVista, Excite, Infoseek, Lycos, Thunderstone, Webcrawler, and Yahoo! to return a single list of results that come from every corner of the Web. Though you can't fine-tune your requests to the extent that you can at some other search sites, you can use MetaCrawler to make a very fast sweep of the Web to see if you're on the right track.

NORTHERN LIGHT

www.northernlight.com
The Editors' Choice—winning North-

ern Light ("Find It on the Web," December 1, 1998) has gained attention for the way it attempts to presort search returns, grouping them into folders based on where they came from and what they are. That strategy gives you a good top-level look at what you've found and can save you time. The site is also notable for its special collections—information from over 4,500 business magazines, trade journals, news wires, and academic journals. Reading an article from the collection usually costs about \$1.



SHOPPING

AMAZON.COM

www.amazon.com
With millions of available titles, this massive, Editors' Choice—winning online book and music store ("Buy It on the Web," November 15, 1998) keeps getting better. (And don't miss the new video and DVD store.) Its 4.5 million registered customers must be happy, because they return often. For good reason: Everything is discounted, sometimes by as much as 40 percent. You can search with ease by keyword, and one-click ordering is hard to resist. You'll also find personal-recommendation features, including a list of books and CDs Amazon.com recommends based on your previous purchases.

COMPARENET

www.comparenet.com
Here's a site that makes any shopper smarter. CompareNet holds your hand through the decision-making process as you contemplate a purchase, whether it's a car, a consumer electronics device or appliance, a software package, or sports equipment—just to name a few of the categories. Pick a type of product and you'll get buyers' tips, advice about important features, and a search tool that asks you what

kinds of features you want and what your price range is. Then CompareNet presents you with a list of products that match your needs (complete with photos). You can jump to other sites to make an online purchase or take the information to the nearest store.

MSN CARPOINT

www.carpoint.msn.com
MSN CarPoint's numbers tell quite a story: 2,000 affiliated dealers, \$300 million in monthly sales, 100,000 used-car listings. Finding the car you want is easy; the state-of-the-art interface, complete with sliders to



reset your parameters on the fly, always presents the best matches the way you want to see them. And new Personal Auto Pages will keep

Google!

Why choose Quantex?



The experts do

"When we replaced our Compaq systems in 1995 with Quantex systems for our executive departments, we not only got fast, powerful, nearly maintenance-free machines, but also dramatically reduced our total cost of ownership. On those rare occasions when we have a service need, the responsiveness of the Quantex staff is incredible. For a business like ours that depends on the uninterrupted flow of information to our customers, Quantex systems deliver everything we expected, and more, at an excellent value."



James Senecal, LAN Specialist, Pacific Life Insurance, Newport Beach, CA.



THE MORE YOU KNOW, THE BETTER QUANTEX GETS.

Quantex's excellent reputation among industry experts and experienced buyers grows stronger by the day. Time after time, the industry's top product reviewers have awarded our systems top honors including "Editors' Choice" and "Best Buy" awards. But when it comes to really knowing what we're about, it's business buyers—like you—who are the real experts. After researching, comparing, and buying Quantex systems, they understand exactly what's reflected in our awards and high industry scores for satisfaction and quality of technical support. In short, they've experienced the satisfaction of owning a Quantex. Still, there are people who don't know that we're one of the world's largest direct marketers of computer systems. After all, it takes time for perception to catch up to reality. So, we'd like to encourage everyone else to get to know us. The sooner the better.

all the time.

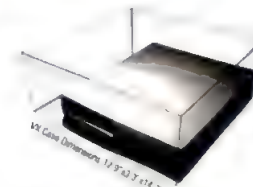
**"Who says business systems have to look boring?
You'll be the envy of the office with the
stylishly curvaceous [Quantex] Slimline next to you."**

c|net Comdex '98 Coverage



INTRODUCING A SMALL AND STYLISH REVOLUTION IN BUSINESS DESKTOP DESIGN—ONLY FROM QUANTEX.

Without sacrificing speed or performance, Quantex VX-Series Slimline PCs pack plenty of raw power and easy, built-in manageability into a small, elegant form factor. Up to 70% smaller than many standard desktops, this full-featured design is configured specifically for businesses and large corporations. Plus, our innovative QSentry technology and advanced network management features come integrated for greater system and network security.



Using up to 70% less desk space than standard desktops, the Quantex VX-Series will do wonders for all business environments.

INTRODUCING!

Quantex VX-400c **\$999**

Business lease: \$35/Mo. Order Code #pcm0273

- Intel® Celeron™ Processor 400MHz
- 32MB SDRAM Memory / 128KB Secondary Cache
- 4.3GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- 15" Digital Monitor (13.8" viewable)
- Intel740 3D ZX AGP Graphics with 8MB SDRAM
- ▲ New Intel Pro 10/100 PCI Fast Ethernet Controller with RJ-45 and Wake-On-LAN Technology
- 32X Max Variable Speed CD-ROM Drive
- ESS Solo Wavetable Sound Card
- ▲ Quantex Slimline Case (12.9"x3.3"x14.2")
- 104-Key Keyboard with MS Mouse
- MS Windows 98
- ▲ QSentry Technology (Including Intel LANDesk Client Manager V3.1)

Quantex VX-400 **\$1499**

Above system with Pentium® II processor 400MHz, 128MB SDRAM, 10.2GB Ultra-ATA HD, and 17" Digital Monitor (15.8" viewable)

INTRODUCING!

Quantex VX-400 **\$1999**

Business lease: \$70/Mo. Order Code #pcm0275

- ▲ Intel® Pentium® II processor 400MHz
- 64MB SDRAM Memory / 512KB Secondary Cache
- 10.2GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
- ▲ Quantex 15" LCD Flat-Panel Display
- Intel740 3D ZX AGP Graphics with 8MB SDRAM
- ▲ New Intel Pro 10/100 PCI Fast Ethernet Controller with RJ-45 and Wake-On-LAN Technology
- 32X Max Variable Speed CD-ROM Drive
- SoundBlaster AudioPCI 64V Wavetable 3D Sound
- ▲ Quantex Slimline Case (12.9"x3.3"x14.2")
- MS Natural Keyboard Elite with MS Mouse
- MS Windows 98
- ▲ QSentry Technology (Including Intel LANDesk Client Manager V3.1)
- Upgrade to Windows NT 4.0, add \$99

Quantex 15" LCD Flat-Panel



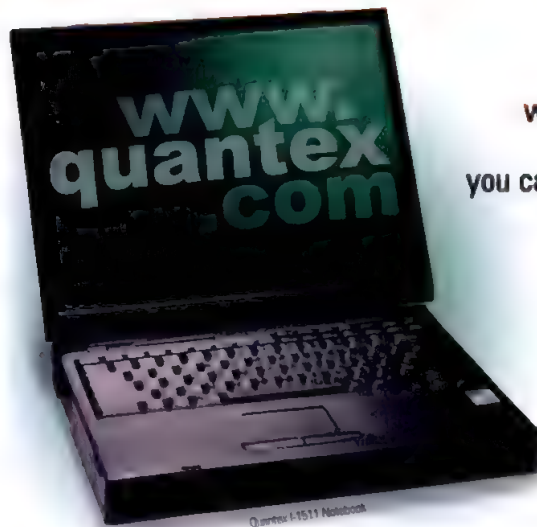
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What those who



"A great buy for professionals who want a wide-screen notebook with very good performance... you can easily deploy the Quantex as a desktop replacement."

WINLIST Award Windows Magazine (Oct. 98)

Introducing the Quantex I-1511 Notebook—complete with a "XX-Large" 15" Active Matrix Display, powerful 96MB of SDRAM, massive 8GB hard drive, sharp ATI 3D AGP Video w/8MB and a built-in 56K V.90 fax/modem—for the incredible price of just \$2899.

IF YOUR LAPTOP SAYS WHO YOU ARE, THE I-SERIES SAYS YOU'RE EXTREMELY POWERFUL

If you demand nothing less for yourself than all the convenience and flexibility of a laptop along with all the enterprise-shaking power of a mega desktop, you'll want to get to know the Quantex I series notebooks. They give you the fastest and most powerful Pentium® II processors, long lasting 12-cell lithium ion batteries, and built-in dual drive bays for simultaneous use of floppy and DVD- or CD-ROM. You also get stunning Active Matrix displays up to 15", and ATI AGP 3D graphics accelerators—all the juice you need to flex your multimedia muscle. You get the idea. Everything you need to know about portable computing power is right on this page.



Big On Screen. Small On Price. Quantex I-Series notebooks are now available with "XX-Large" 15" displays. Check them out starting at just \$2499.

I-SERIES NOTEBOOKS

Quantex I-1410 \$2199

Order Code #pcm0258

- Business lease: \$77/Mo.**
- Pentium® II processor 266MHz
 - 14.1" XGA Active Matrix Display
 - 64MB SDRAM
 - 4GB Ultra-ATA HD
 - 56K V.90 Fax/Modem
 - Removable Combo 24X CD-ROM Drive & 3.5" Floppy Drive
 - New ATI Rage Lt Pro 3D AGP Video w/8MB
 - New ESS 3D Wavetable Surround Sound and Speakers
 - New Long-Lasting 12-Cell Smart Lithium Ion Battery
 - USB and Fast IR Ports / Integrated Personal Touchpad
 - MS Windows 98
 - Microsoft Office 97 SBE v2.0
 - Quantex Carrying Case
 - Year 2000 Compliant
 - 3-year limited warranty on CPU and Main Memory
 - 1-year parts and labor warranty on all other components
 - Upgrade from 64MB SDRAM to 128MB SDRAM, add \$149
 - Upgrade from 4GB Ultra-ATA HD to 8GB Ultra-ATA HD, add \$129

INTRODUCING!

Quantex I-1510 \$2499

Order Code #pcm0280

- Business lease: \$88/Mo.**
- Pentium® II processor 266MHz
 - 15" XGA Active Matrix Display
 - 64MB SDRAM
 - 6GB Ultra-ATA HD
 - 56K V.90 Fax/Modem
 - Removable Combo 2X DVD-ROM Drive & 3.5" Floppy Drive
 - New ATI Rage Lt Pro 3D AGP Video w/8MB
 - New ESS 3D Wavetable Surround Sound and Speakers
 - New Long-Lasting 12-Cell Smart Lithium Ion Battery
 - USB and Fast IR Ports / Integrated Personal Touchpad
 - MS Windows 98
 - Microsoft Office 97 SBE v2.0
 - Quantex Carrying Case
 - Year 2000 Compliant
 - 3-year limited warranty on CPU and Main Memory
 - 1-year parts and labor warranty on all other components
 - Upgrade from 64MB SDRAM to 128MB SDRAM, add \$149
 - Upgrade from 6GB Ultra-ATA HD to 8GB Ultra-ATA HD, add \$199

Quantex I-1411 \$2699

Order Code #pcm0250

- Business lease: \$94/Mo.**
- Pentium® II processor 300MHz
 - 14.1" XGA Active Matrix Display
 - 128MB SDRAM
 - 6GB Ultra-ATA HD
 - 56K V.90 Fax/Modem
 - Removable Combo 2X DVD-ROM Drive & 3.5" Floppy Drive
 - New ATI Rage Lt Pro 3D AGP Video w/8MB
 - New ESS 3D Wavetable Surround Sound and Speakers
 - New Long-Lasting 12-Cell Smart Lithium Ion Battery
 - USB and Fast IR Ports / Integrated Personal Touchpad
 - MS Windows 98
 - Microsoft Office 97 SBE v2.0
 - Quantex Carrying Case
 - Year 2000 Compliant
 - 3-year limited warranty on CPU and Main Memory
 - 1-year parts and labor warranty on all other components
 - Upgrade from 6GB Ultra-ATA HD to 8GB Ultra-ATA HD, add \$199

INTRODUCING!

Quantex I-1511 \$2899

Order Code #pcm0281

- Business lease: \$101/Mo.**
- Pentium® II processor 300MHz
 - 15" XGA Active Matrix Display
 - 96MB SDRAM
 - 8GB Ultra-ATA HD
 - 56K V.90 Fax/Modem
 - Removable Combo 2X DVD-ROM Drive & 3.5" Floppy Drive
 - New ATI Rage Lt Pro 3D AGP Video w/8MB
 - New ESS 3D Wavetable Surround Sound and Speakers
 - New Long-Lasting 12-Cell Smart Lithium Ion Battery
 - USB and Fast IR Ports / Integrated Personal Touchpad
 - MS Windows 98
 - Microsoft Office 97 SBE v2.0
 - Quantex Carrying Case
 - Year 2000 Compliant
 - 3-year limited warranty on CPU and Main Memory
 - 1-year parts and labor warranty on all other components
 - Upgrade from 96MB SDRAM to 128MB SDRAM, add \$99

I-Series Upgrade Options:

- Quantex Mini-Docking Station, add \$149
- 12-Cell Long-Lasting Lithium Ion Battery, add \$149
- PCMCIA Network Interface Card, add \$129
- Quantex Deluxe Carrying Case, add \$99

I know, know.



"The Quantex QP6/SB-4 is a sturdy, practical machine. Designed for the business user...it comes with the creature comforts that anyone putting in overtime would appreciate. Good price and top-notch support policy."

PC World (June 98)



BUILT-IN ADVANCED MANAGEMENT CAPABILITIES LOWER YOUR TOTAL COST OF OWNERSHIP

Whether your business is at home or spread across the globe, the enterprise management technology integrated into our Business Desktops will add real value while lowering your total cost of ownership. Built according to industry-standard initiatives such as Wired for Management, DMI 2.0, PC98 and ACPI, these systems incorporate capabilities for improved asset management as well as remote configurations and diagnostics. Plus, our advanced QSentry Technology assures unsurpassed confidence and security at all times by constantly monitoring the health of your Quantex PCs. Why settle for simple performance when your business can also benefit from compliance and assurance?

Windows® 2000 Ready PCs

Quantex's Windows 2000-Ready Business Desktops come installed with Windows NT Workstation 4.0 to protect your technology investment by providing an optimal upgrade path for future hardware advances and the highly anticipated Windows 2000 operating system.

BUSINESS DESKTOPS

QP6/333 SB-1c \$999

- Business lease: \$35/Mo.** Order Code #pcm0230
- Intel® Celeron™ Processor 333MHz
 - 32MB SDRAM Memory / 128KB Secondary Cache
 - 4.3GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
 - 17" Digital Monitor (15.8" viewable)
 - 64-bit 3D AGP Graphics Card with 4MB VRAM
 - New Intel Pro 10/100 PCI Fast Ethernet Controller w/RJ-45 and Wake-On-LAN Technology
 - 32X Max Variable Speed CD-ROM Drive
 - 2 Universal Serial Bus (USB) Ports / DMI 2.0
 - Quantex ATX Mid Tower Case
 - 104-Key Keyboard with MS Mouse
 - MS Windows 98
 - 3-year limited warranty with 1-year On-Site Service*
 - 24-hr/7-day Technical Support
 - QSentry Technology (Including Intel LANdesk Client Manager V3.1)
 - Cable Modem Ready / Year 2000 Compliant

QP6/400 SB-1c \$1199

Above system with Intel Celeron processor 400MHz, 64MB SDRAM, 6.4GB HD

QP6/400 SB-2 \$1499

Above system with Intel Pentium II processor 400MHz, 64MB SDRAM, 8.4GB HD, Intel740 3D AGP Video w/8MB and MS Office 97 SBE v2.0

QP6/450 SB-3 \$1899

- Business lease: \$67/Mo.** Order Code #pcm0233
- Pentium® II processor 450MHz
 - 64MB PC100 SDRAM Memory / 512KB Secondary Cache
 - 8.4GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
 - 17" Monitor w/OSD & NEC ChromaClear CRT (16.0" viewable) 1600x1200 max resolution 25dp
 - Intel740 3D ZX AGP Graphics w/8MB SDRAM
 - New Intel Pro 10/100 PCI Fast Ethernet Controller w/RJ-45 and Wake-On-LAN Technology
 - 32X Max Variable Speed CD-ROM Drive
 - 2 Universal Serial Bus (USB) Ports / DMI 2.0
 - Quantex ATX Mid Tower Case
 - 104-Key Keyboard with MS IntelliMouse
 - MS Windows NT Workstation 4.0 / Microsoft Office 97 SBE v2.0
 - 3-year limited warranty with 1-year On-Site Service*
 - 24-hr/7-day Technical Support
 - QSentry Technology (Including Intel LANdesk Client Manager V3.1)
 - Cable Modem Ready / Year 2000 Compliant / Windows 2000 Ready

QP6/450 SB-4 \$2199

Above system with 128MB SDRAM 13GB HD, New Ultra-Fast #9 Revolution IV 128-bit 3D AGP Video & 19" Digital Monitor (18.1" viewable)



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VALUE MULTIMEDIA

QP6/400 M-1c \$1099

- Business lease: \$39/Mo. Order Code #pcm0205**
- New Intel® Celeron® Processor 400MHz
 - 64MB SDRAM Memory / 128KB Secondary Cache
 - 6.4GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
 - 15" Digital Monitor (13.8" viewable)
 - 64-Bit 3D AGP Graphics Accelerator with 4MB
 - 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
 - 32X Max Variable Speed CD-ROM Drive
 - SoundBlaster AudioPCI 64V Wavetable 3D Sound
 - Altec-Lansing ACS-90 Speakers
 - Quantex ATX Mid Tower Case
 - 104-Key Keyboard with MS Mouse
 - MS Windows 98 / Value Multimedia Software Bundle
 - 3-year limited warranty with 1-year On-Site Service**
 - ▲ Year 2000 Compliant
 - Upgrade to 17" Digital Monitor (15.8" viewable), add \$89
 - Upgrade to 8MB AGP Graphics Accelerator, add \$39

QP6/333 M-1c(with Intel Celeron processor).....\$1049
QP6/350 M-1c(with Pentium II processor).....\$1149

SOFTWARE: Corel Office Suite 8 • Internet the City • Compton's Interactive Encyclopedia • Body Works 6.0 • Amazon Trail II • MS Money '97 (pre-loaded only) • American Heritage Talking Dictionary • Dr. Solomons Find-Virus (pre-loaded only) • Compton's Reference Collection • MS Internet Explorer 4.0

QP6/400 M-2x \$1499

- Business lease: \$53/Mo. Order Code #pcm0206**
- Pentium® II Processor 400MHz
 - 64MB SDRAM Memory / 512KB Secondary Cache
 - 8.4GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
 - 17" Digital Monitor w/OSD (15.8" viewable)
 - Toshiba MPACT2 3D/DVD Media Accelerator w/8MB VRAM
 - 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
 - New 3rd-Generation 4.8X DVD-ROM Drive
 - SoundBlaster AudioPCI 64V Wavetable 3D Sound
 - Altec-Lansing ACS-90 Speakers
 - Quantex ATX Mid Tower Case
 - 104-Key Keyboard with MS Mouse
 - MS Windows 98 / Value Multimedia Software Bundle
 - 3-year limited warranty with 1-year On-Site Service**
 - ▲ Year 2000 Compliant
 - Upgrade to 17" Monitor w/NEC ChromaClear CRT for \$79
 - Optional Internal Zip Drive w/one cartridge, add \$79
 - Optional Altec Lansing ACS-251 Subwoofer, add \$39

QP6/350 M-2x(with Pentium II processor).....\$1349
QP6/450 M-2x(with Pentium II processor).....\$1699

QP6/400 M-3x \$1599

- Business lease: \$56/Mo. Order Code #pcm0207**
- Pentium® II Processor 400MHz
 - 64MB PC100 SDRAM Memory / 512KB Secondary Cache
 - 10.2GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
 - 17" Digital Monitor w/OSD (15.8" viewable)
 - Toshiba MPACT2 3D/DVD Media Accelerator w/8MB VRAM
 - Internal 100MB Zip Drive with one cartridge
 - 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
 - New 3rd-Generation 4.8X DVD-ROM Drive
 - SoundBlaster AudioPCI 64V Wavetable 3D Sound
 - Altec-Lansing ACS-90 Speakers
 - Quantex ATX Mid Tower Case
 - 104-Key Keyboard with MS Mouse
 - MS Windows 98
 - Value Multimedia Software Bundle
 - 3-year limited warranty with 1-year On-Site Service**
 - ▲ Year 2000 Compliant
 - Upgrade to 17" Monitor w/NEC ChromaClear CRT for \$79

QP6/350 M-3x(with Pentium II processor).....\$1449
QP6/450 M-3x(with Pentium II processor).....\$1799

QP6/450 Best Buy \$1999

- Business lease: \$70/Mo. Order Code #pcm0208**
- Pentium® II Processor 450MHz
 - 128MB PC100 SDRAM Memory / 512KB Secondary Cache
 - 13GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
 - 19" Monitor w/OSD (18.1" viewable), 1600x1200, 26dp
 - Intel740™ 3D 2X AGP Graphics with 8MB SDRAM
 - 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
 - New 3rd-Generation 4.8X DVD-ROM Drive
 - SoundBlaster AudioPCI 64V Wavetable 3D Sound
 - Altec-Lansing ACS-90 Speakers
 - Quantex ATX Mid Tower Case
 - 104-Key Keyboard with MS Mouse
 - MS Windows 98 / Value Multimedia Software Bundle
 - 3-year limited warranty with 1-year On-Site Service**
 - ▲ Year 2000 Compliant
 - Optional Internal Zip Drive w/one cartridge, add \$79
 - Optional Altec Lansing ACS-251 Subwoofer, add \$39

QP6/400 Best Buy(with Pentium II processor).....\$1849

POWER MULTIMEDIA

QP6/350 SM-1x \$1399

- Business lease: \$49/Mo. Order Code #pcm0220**
- Pentium® II Processor 350MHz
 - 64MB PC100 SDRAM Memory / 512KB Secondary Cache
 - 8.4GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
 - 17" Digital Monitor w/OSD (15.8" viewable)
 - Intel740™ 3D 2X AGP Graphics with 8MB SDRAM
 - 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
 - 32X Max Variable Speed CD-ROM Drive
 - SoundBlaster AudioPCI 64V Wavetable 3D Sound
 - Altec-Lansing ACS-90 Speakers
 - Quantex ATX Mid Tower Case
 - MS Natural Keyboard Elite with MS IntelliMouse
 - MS Windows 98
 - Power Multimedia Software Bundle
 - Microsoft Office 97 SBE v2.0
 - 3-year limited warranty with 1-year On-Site Service**
 - ▲ Year 2000 Compliant
 - Upgrade to 10.2GB Ultra-ATA Hard Drive, add \$49
 - Upgrade to 3rd-Gen. 4.8X DVD-ROM Drive, add \$79
 - Upgrade to Altec Lansing ACS-45.1 PowerCube Speakers with Subwoofer, add \$49
 - Optional Internal Zip Drive w/one cartridge, add \$79

QP6/400 SM-2x \$1799

- Business lease: \$63/Mo. Order Code #pcm0221**
- Pentium® II Processor 400MHz
 - 128MB PC100 SDRAM Memory / 512KB Secondary Cache
 - 13GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
 - 17" Digital Monitor w/OSD (15.8" viewable)
 - New 3Dfx 128-bit Voodoo Banshee 3D AGP Video w/16MB
 - Based on award-winning Voodoo2 3D Technology
 - 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
 - New 3rd-Generation 4.8X DVD-ROM Drive
 - SoundBlaster AudioPCI 64V Wavetable 3D Sound
 - Altec-Lansing ACS-90 Speakers
 - Quantex ATX Mid Tower Case
 - MS Natural Keyboard Elite with MS IntelliMouse
 - MS Windows 98 / Power Multimedia Software Bundle
 - Microsoft Office 97 SBE v2.0
 - 3-year limited warranty with 1-year On-Site Service**
 - ▲ Year 2000 Compliant
 - Upgrade to Altec Lansing ACS-45.1 PowerCube Speakers with Subwoofer, add \$49
 - Optional Internal Zip Drive w/one cartridge, add \$79

QP6/350 SM-2x(with Pentium II processor).....\$1649

QP6/400 SM-3x \$1999

- Business lease: \$70/Mo. Order Code #pcm0222**
- Pentium® II Processor 400MHz
 - 128MB PC100 SDRAM Memory / 512KB Secondary Cache
 - 13GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
 - 19" Monitor w/OSD (18.1" viewable), 1600x1200, 26dp
 - New 3Dfx 128-bit Voodoo Banshee 3D AGP Video w/16MB
 - Based on award-winning Voodoo2 3D Technology
 - 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
 - New 3rd-Generation 4.8X DVD-ROM Drive
 - SoundBlaster AudioPCI 64V Wavetable 3D Sound
 - Altec-Lansing ACS-45.1 PowerCube Speakers w/subwoofer
 - Quantex ATX Mid Tower Case
 - MS Natural Keyboard Elite with MS IntelliMouse
 - MS Windows 98 / Power Multimedia Software Bundle
 - Microsoft Office 97 SBE v2.0
 - 3-year limited warranty with 1-year On-Site Service**
 - ▲ Year 2000 Compliant
 - Upgrade to Ultra-Fast #9 Revolution IV 128-bit 3D AGP Video w/32MB, add \$49
 - Optional Internal Zip Drive w/one cartridge, add \$79

QP6/450 SM-3x(with Pentium II processor).....\$2199

QP6/450 SM-4x \$2399

- Business lease: \$84/Mo. Order Code #pcm0223**
- Pentium® II Processor 450MHz
 - 128MB PC100 SDRAM Memory / 512KB Secondary Cache
 - New 17.2GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
 - New 19" Monitor w/NEC ChromaClear CRT (18.1" viewable), 1600x1200, 25dp
 - New 3Dfx 128-bit Voodoo Banshee 3D AGP Video w/16MB
 - Based on award-winning Voodoo2 3D Technology
 - Internal 100MB Zip Drive with one cartridge
 - 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
 - New 3rd-Generation 4.8X DVD-ROM Drive
 - SoundBlaster AudioPCI 64V Wavetable 3D Sound
 - New Altec-Lansing ADA-305 Dolby Pro Logic Surround Sound Speakers with subwoofer
 - Quantex ATX Mid Tower Case
 - MS Natural Keyboard Elite with MS IntelliMouse
 - MS Windows 98 / Power Multimedia Software Bundle
 - Microsoft Office 97 SBE v2.0
 - 3-year limited warranty with 1-year On-Site Service**
 - ▲ Year 2000 Compliant
 - Upgrade to Ultra-Fast #9 Revolution IV 128-bit 3D AGP Video w/32MB, add \$49

SUPER MULTIMEDIA

QP6/450 M-4x SE \$2199

- Business lease: \$77/Mo. Order Code #pcm0209**
- Pentium® II Processor 450MHz
 - 128MB PC100 SDRAM Memory / 512KB Secondary Cache
 - New 17.2GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
 - New 19" Monitor w/NEC ChromaClear CRT (18.1" viewable), 1600x1200, 25dp
 - Intel740™ 3D 2X AGP Graphics with 8MB SDRAM
 - Internal 100MB Zip Drive with one cartridge
 - 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
 - New 3rd-Generation 4.8X DVD-ROM Drive
 - SoundBlaster AudioPCI 64V Wavetable 3D Sound
 - Altec-Lansing ACS-90 Speakers
 - Quantex ATX Mid Tower Case
 - 104-Key Keyboard with MS Mouse
 - MS Windows 98
 - Value Multimedia Software Bundle
 - 3-year limited warranty with 1-year On-Site Service**
 - ▲ Year 2000 Compliant
 - Optional Altec Lansing ACS-251 Subwoofer, add \$39

QP6/400 M-4xSE(with Pentium II processor).....\$1999

QP6/450 SM-4x SE \$2899

- Business lease: \$101/Mo. Order Code #pcm0224**
- Pentium® II Processor 450MHz
 - 256MB PC100 SDRAM Memory / 512KB Secondary Cache
 - New 17.2GB Ultra ATA HD / 3.5" 1.44MB Floppy Drive
 - 21" Monitor w/OSD (20.0" viewable), 1600x1200
 - New 3Dfx 128-bit Voodoo Banshee 3D AGP Video w/16MB
 - Based on award-winning Voodoo2 3D Technology
 - Internal 100MB Zip Drive with one cartridge
 - 56K V.90 PCI Fax/Modem* w/Voice Mail and Speakerphone
 - New 3rd-Generation 4.8X DVD-ROM Drive
 - SoundBlaster AudioPCI 64V Wavetable 3D Sound
 - New Altec-Lansing ADA-305 Dolby Pro Logic Surround Sound Speakers with subwoofer
 - Quantex ATX Mid Tower Case
 - MS Natural Keyboard Elite with MS IntelliMouse
 - MS Windows 98 / Power Multimedia Software Bundle
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 - Quantex ATX Mid Tower Case
 - 104-Key Keyboard with MS Mouse
 - MS Windows 98 / Value Multimedia Software Bundle
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SHOPPING.COM

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SOFTWARE DOWNLOADS

DAVE CENTRAL

www.davecentral.com

Dave Central doesn't actually host the files it lists for downloading; rather, it points to other download

and Palm III are traveling the world in shirt pockets today, and the cult continues to grow. People are fanatical about these little gadgets, in part because there is so much great software to load onto them and take



DAVE CENTRAL

SOFTWARE ARCHIVE

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PALMPILOT GEAR HQ

www.palmpilotgear.com

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with you on the road. If you're a Palmer, then you should definitely bookmark this site, which is utterly comprehensive in its collection of PalmPilot extras. Some are for sale and some free. Search for what you need; chances are you'll find it.

SOFTWARE LIBRARY

www.hotfiles.zdnet.com

This ZDNet site offers thousands of freeware and shareware downloads, and if you're not even sure what you're looking for, there's no need to fear. Preston Gralla and his team of experts guide you to their favorite picks, list the most popular downloads, and even present a hot file of the day so you'll never miss the best the best new stuff. (ZDNet, publisher of Software Library, is a property of Ziff-Davis, the publisher of PC Magazine.)

TUCOWS

www.tucows.com

TUCOWS is a huge software database, with over 460 affiliate "mirror" sites. Each program listed for download is accompanied by a capsule review



and a rating so you can decide which ones are worth your time.

As one of the original download sites on the Web,

TUCOWS has had plenty of time to refine its interface; it's one of the best-organized collections around.

SPORTS

CNN SI

www.cnn.si.com

As its name suggests, CNN SI draws on two very strong sources for its content: CNN and *Sports Illustrated*. The result is a full-featured site that, unlike ESPN.com, is entirely free (except for the pay-to-play fantasy leagues) and features not just up-to-the-minute headlines but also the kind of deep-thought feature journalism that's a hallmark of SI.

ESPN.COM

www.espn.com

The recently redesigned ESPN.com is at the top of its game. Although you have to pay to take advantage of some services, the site offers all that its cable-TV cousin does: scores, stories, stats, schedules, standings, video screenings, and sound. The daily, up-to-the minute analyses and features help keep you on top of everything from NCAA basketball to the Stanley Cup playoffs.

GOLFWEB

www.golfweb.com

No Web site devoted to a single sport is more comprehensive than GolfWeb. Created in association with CBS SportsLine, the site has a strong focus on tour news but also includes a well-stocked store and OnCourse, a guide to 21,000 courses.

es. You can also join the pay-to-play Player's Club, where you enter round information from your scorecards and obtain statistics and analysis of your games and areas for improvement. You can even match your scores against those of others who have played the same courses.

THE SPORTING NEWS

www.sportingnews.com

True sports fans know that their sports bookmark lists aren't complete without the hardcore, in-depth coverage that *The Sporting News* has been providing on paper for decades and online for the past few years. Thirty big-name columnists analyze the ins and outs of every major sport, and yes, there's plenty to keep the stats freaks busy. Customization is also available to make your favorite sports and teams bubble to the surface.



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www.usatoday.com/sports/sfront.htm

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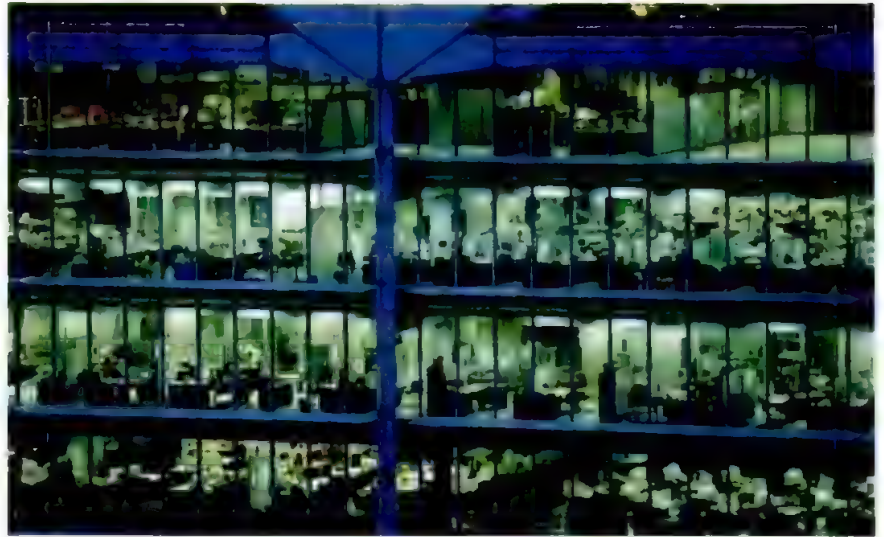
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Network Associates is the worldwide leader in network security and management tools for enterprise networks.



Newmarket Software Systems, Inc. is the international leader in hospitality, sales, marketing and catering automation, used by over 2,500 properties worldwide.



ONYX Software is a leading provider of enterprise relationship management solutions with an installed-base of over 300 world-class companies.



Pivotal provides 360° enterprise customer relationship management applications that unify sales, marketing, and support to increase sales, profits, and customer satisfaction.



Radius Retail develops OpenRSA, a proven client/server retail management system containing the functionality necessary to stay ahead in today's retail environment.



SalesLogix provides integrated sales automation and customer support software that's customizable, quickly implemented and fully scalable.



Siebel Systems, Inc. is the world's leading supplier of Enterprise Relationship Management systems for organizations focused on increasing sales, marketing and customer service.



Vantive, a worldwide leader in the front-office market, provides software that increases call center, sales, marketing, helpdesk, and field service effectiveness.

Microsoft

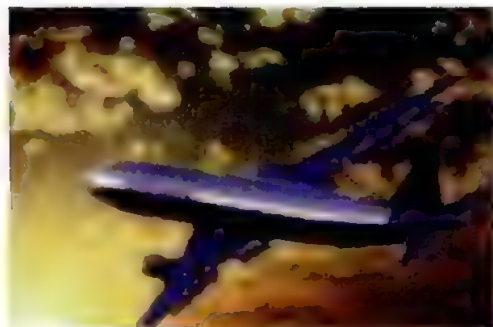
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BIZTRAVEL.COM

www.biztravel.com

BizTravel.com starts off by letting you enter the most detailed personal profile of any travel site. It particularly distinguishes itself in its management of frequent-traveler programs. BizTravel.com tracks your miles and helps you maximize awards when you book flight, car, and hotel reservations. It gives you the greatest flexibility in updating your profile and setting multiple preferences when finding rates, and its interface is clear and helpful. Also included at the site: city guides and an interesting online travel magazine.

MSN EXPEDIA

www.expedia.msn.com

This past October, MSN Expedia streamlined its interface once again, making the potentially confusing task

of planning your travels a little easier. At the same time, it added a discount travel mall called the Expedia Travel Network, which is full of leisure travel deals and special-interest vacations.

Don't miss Expedia's cool mapping features, including useful hotel pin-pointers; they're unmatched by any competitor. And take note: Expedia has a staff of 150 travel agents on call to help you

with your online reservations.

PREVIEW TRAVEL

www.previewtravel.com

With an extensive collection of vacation packages and support for multiple profiling, Preview Travel is geared toward both business travelers and vacationers—but with a strong consumer orientation. (Five million people are registered.) The site is well laid out and stylish in its presentation, and we like the fact that it integrates lots of city information from Fodor's. Travelers who can plan around low-fare availability will like Farefinder, a page that's

updated four times a day with valuable low-fare news and an excellent search capability for cheap flights about a month in the future. Vacation specials

are a prominent aspect of Preview Travel's service, too, so take a look as you plan your next vacation.

TRAVELOCITY

www.travelocity.com

Travelocity is the Internet version of Sabre's reservations network, and we've noticed that it consistently finds fares that can't be beaten on airlines' own sites. You'll like being

able to set several ranked criteria (price, time, airline, or number of stops) when searching for fares, and you can create profiles for both business and pleasure and store all your frequent traveler numbers for air travel, hotel stays, and car rentals.

WEB-BASED SERVICES

DEJANEWS

www.dejanews.com

Despite the ascendancy of the Web, Internet Usenet newsgroups haven't gone away. In fact, they're flourishing with easy-to-use Web-based interfaces like the one DejaNews provides. The site gives you a simple way to search through 50,000 newsgroups to find the topics that interest you. And with My DejaNews, you can access your favorite forums from any Web-ready PC and post messages via a Web-based, spam-filtered e-mail service.



travel information prepared in affiliation with the Mobil Travel Guides. You'll also appreciate the new

QuickMaps menu, which lets you jump right to maps of almost 50 U.S. and international cities.

REGISTER.COM

www.register.com

Anyone who wants to set up a Web site with a catchy, distinctive address has to register the domain name with InterNIC. Register.com is the single easiest place to get it done. The six-step service, which is free, guides you through the process. And the site has an excellent FAQ section that describes all the ins and outs of site-naming conventions, including an interesting explanation of the .tv domain that's sold by the Tuvalu islands.

WEBRING

www.webring.org

Have you caught onto the Web ring concept yet? It's the easy way to connect your Tori Amos site with all



the other Tori Amos sites out there, giving Tori fans a chance to hop from one site to the next without going

back to a search engine. Thousands of rings already exist, with more arriving each day. This is the site that manages and lists all the rings and provides the code you need to attach your site to the ring.

MAPQUEST

www.mapquest.com

In addition to the menu of trip directions, maps, and yellow-page listings that you've come to expect from MapQuest, the site now has routes to and from street intersections and airports, a map store, and improved



SONY



By all means, think **outside** the box. Just put it **all** back when you're done.

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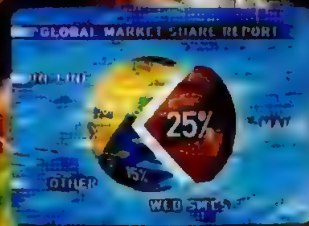
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My real job is being a single dad, but my business card says I'm an architect.

The other day we're upgrading the office, and I'm doing the buying. We need five screaming Intel® Pentium® II boxes, two PC servers and several color printers. So I pop onto ZDNet's Products Review channel to read some reviews, then click over to computershopper.com to shop, compare and buy. An hour later my work is done.

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WEB DEVELOPMENT

DEVHEAD

www.devhead.com

This Web developers's site, new from ZDNet, is still building up steam, but it's already attracted marquee contributors, including world-famous design guru Jakob Nielsen and Java expert Rick Scott. You'll also benefit from the half

GAMELAN

www.gamelan.com

Got a craving for Java? Gamelan is sure to satisfy it, with listings of thousands of Java applets and Java-related sites. You'll find categorized lists of Java applets and What's New and What's Cool sections to make your searches easier. A brief sum-

our Top 100 list, some of its more strident community members vocally expressed their resentment at being included. Nevertheless, the site is still here, and we still like its "news for nerds" and "stuff that matters." This online community of techies and gearheads posts interesting articles about programming and then discusses them at length. The site is especially good for Linux developers and open-source experts, but anyone with an interest in development will have a good time here.

WEBDEVELOPER.COM

www.webdeveloper.com

This site has much more than just the magazine *InternetWorld* behind it. It's a great place for developers to keep up with Internet use as well as programming and coding tricks. Browsing by category is an easy way of getting around, and you can

always consult Dr. Website with your Webmaster aches and pains.

THE WORLD WIDE WEB CONSORTIUM

www.w3.org

The W3C is the Vatican of the Web, an international consortium devoted to guiding the Web's evolution. The group seeks to develop open, technologically sound specifications to enhance the Web's user interface and architecture. It also looks for ways to address the Web's societal issues with technology. The W3C Reference Library (Libwww) is a general-purpose Web API written in C. It can be used as the code base for writing Web clients, servers, and proxies. Libwww provides reference



code for HTTP and other Internet protocols, as well as for handling many media types, including HTML. 



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State-of-the-Art, Lightweight portables

The latest Windows CE devices go head to head with the hottest mini-notebooks. By Bill Howard

the roadside is littered with the wrecks of personal digital assistants and tablet computers—products that dared to be different but forgot they also needed to be useful. Windows CE hand-helds may turn out to be more successful, because they have that history to learn from.

Here we review Jupiter-class hand-held PC professional (H/PC Pro) systems, which are 2.5-pound devices that look and act somewhat like further downsized mini-notebook PCs, shipping as of late fall. We also review 3-pound mini-notebooks (also known as ultraportables) that run the real thing: Windows 98.

Testing in PC Magazine Labs, we found the four Windows CE devices interesting works in progress and the six Windows mini-notebooks to be generally useful, downsized laptops.

We missed the Ricoh Magio mini-notebook in this roundup. The current version, priced at \$2,000, weighs 2.8 pounds, has a 9.2-inch TFT LCD, 32MB



PHOTOGRAPHS BY MERT KERNIM

Windows CE (typical)

CPU: Varies, mostly RISC-based
Screen: Dual-scan passive color (7 by 5 inches)
RAM: 16MB
ROM (for applications): 16MB
Key pitch: 16.5 mm
Weight: 2.5 pounds
Dimensions (HWD): 1.1 x 9.5 x 7.5 inches
Battery life: 8 hours of continuous use
Extra storage: CompactFlash (96MB)
Modem: Built-in (typically software)
PC Card: One Type II slot

Mini-Notebooks (typical)

CPU: Varies, typically Pentium MMX
Screen: Active Color (10.4-inch diagonal)
RAM: 32MB
Key pitch: 16.5 mm
Weight: 3 pounds
Dimensions (HWD): 1.1 x 10 x 8.5 inches
Battery life: 2-5 hours
Storage: 3 to 4GB hard disk
Floppy disk drive: External
Modem: Built-in (hardware)
PC Card: Type II and Type III

Windows CE Devices

PRO: Half the price of mini-notebooks; have instant-on; batteries last all day (or longer); no moving parts to break; lighter; more manageable than mini-notebooks or full-size laptops.

CON: Windows CE applications are more compact and have limited function; local storage limited to RAM and CompactFlash (96MB); few e-mail clients; hard-to-read screens; low computing power for processing larger files.



Mini-Notebooks

PRO: Notebook-level power; true and familiar Windows applications; larger, brighter screens; plenty of storage space.

CON: Twice the cost of Windows CE devices; less than one-third the battery life; still have fewer built-in ports than full-size notebooks; more delicate than Windows CE devices.

of RAM, and a Pentium MMX/233—a 266-MHz model will be available soon. Ricoh only recently entered the market with its own branded systems; it had manufactured systems for others previously.

WATCHWORD: COMPROMISE

Both the mini-notebooks and the Windows CE devices require compromise.

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Mini-notebooks:

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We found mini-notebooks less powerful than full-size systems although they do the job. Compared with standard laptops, battery life is lower and keyboards are more cramped. And you'll forego one or more ports—most systems have audio, a PC Card slot, an external floppy disk drive, and a modem, but lack integrated VGA, serial, parallel, and PS/2 ports. You'll need the bundled port replicator in order to use these.

Windows CE systems are lighter than mini-notebooks, offer instant-on, last all day, and can be easily managed, but they lack adequate storage and have to contend with feature-stripped "Pocket" Microsoft applications. Mobile presenters, one target audience, cannot customize their Microsoft PowerPoint presentations, because Pocket PowerPoint limits file edits to the title slide. Many of these systems target heavy on-the-road e-mail users, but e-mail clients, aside from Microsoft Outlook, are lacking. As other vendors add e-mail support for these devices, check whether you're getting a first-generation e-mail browser that lets

you handle mail only when you're connected to a mail server, or if you can actually store your e-mail locally. Our tests also found that these low-power systems take several minutes to open larger files.

You'll need a host PC or file server for software downloads to Windows CE devices—none has a CD or floppy disk drive—and for creating files that can't be created directly. They lack parallel ports but all have infrared (IrDA) ports. Few desktop PCs or printers have IrDA ports, however, and few users know how to make them work on notebooks that do. This will improve in a year or two if the Bluetooth transfer protocol takes off.

Windows CE units may not be right for you. But they may be right for somebody in your company who could use a mobile device but doesn't now use a portable, or who uses a notebook but only a

handful of its features, or who needs only a compact vertical application.

WINDOWS CE FLAVORS

Microsoft envisions Windows CE running on everything from consumer appliances to car PCs. Currently it's for three classes of hand-helds:

- Jupiter-class (a Microsoft prelaunch code name still used) or H/PC Pro systems, which typically have backlit VGA color LCDs, weigh 2 to 3 pounds, and have the potential to supplant some notebooks. Input is by pen, pointing stick, or touch pad. These products run Windows CE 2.11.

- Mercury-class or hand-held PC (HPCs or H/PCs) systems, which weigh 1 to 1.5 pounds with scrunched keys—allowing no real touch-typing—and monochrome half-VGA (640-by-240) displays. They use the earlier Windows CE 2.0. To many users, they're "tweeners"—too bulky to fit in a jacket pocket, too small to get much work done. If this category fades, you may see

HPC used generically for all three classes.

- Gryphon-class systems, which weigh half a pound and look like 3Com Palm devices but run Windows CE. For a time last spring, Microsoft called these Windows CE devices PalmPCs, causing endless confusion because 3Com had shortened the name of its best-selling product from Palm Pilot to Palm (to avoid legal hassles with Pilot Pen). Microsoft backed down under threat of a 3Com lawsuit and now calls the devices Palm-size PCs or P/PCs. Look for some of these to get color displays soon and then for a Windows CE 3.0 enhancement with an interface that scales down to work better on smaller displays.

THE SHAPE OF THINGS

Currently, Jupiter devices are far from uniform. The Windows CE HP Jornada 820 Handheld PC and the Sharp Mobilon Pro PV-5000 we review here neatly fit the size and weight descriptions of H/PC Pros. In comparison, the half-size LG Phenom Express has a 640-by-240 display, but its 16.5-mm-pitch keyboard was quite useful. The Vadem Clio, also sold by Sharp as the Mobilon TriPad, converts from standard Windows CE unit to tablet computer to easel computer, although the flip screen and arms raise the system weight to 3.2 pounds.

Expect the majority of future Windows CE Jupiter units to look mainstream—more like downsized notebook PCs. The 2.5-pound NEC Mobile Pro 800 will have a 9.4-inch 800-by-600 display. And the 2.6-pound IBM Mobile Companion may share a keyboard design and a similar case design with a future 2.5- to 3-pound Windows notebook. Uniquely, the Mobile Companion will have a Type III PC Card slot, which can hold a PC Card hard disk (170 or 340MB). Hitachi also has a new Windows CE device coming out.

PROS AND CONS FOR BUSINESS

Windows CE H/PC Pros make sense for users with custom applications that can be made to fit in the fixed space available. While IT managers don't like the idea of supporting Yet Another Operating System, they do like the fact that there are fewer oddball applications and games that users can install.

In fact, these Windows CE devices appear to be more for business than for

www.pcmag.com

Join us online for an interactive look at this roundup of four Windows CE devices and six mini-notebooks.

Our Contributors: BILL HOWARD is a senior executive editor of *PC Magazine*. CADE METZ is a senior writer and ANGELA TUKA is an editorial researcher at *PC Magazine*. RICH FISCO was the senior project leader, and ANUSH YEGYAZARIAN was the associate editor in charge of this story.

Editors' Choice

- Sharp Actius A100 Ultra Lite PC
- Toshiba Portégé 3010CT
- Windows CE devices: Not ready yet



Our two Editors' Choices, the Sharp Actius A100 UltraLite PC and the Toshiba Portégé 3010CT, each

\$2,000 (street), offer you ample processing power for most tasks in thin and lightweight packages, that, combined with their good battery life, make them ideal road companions.

The two units have a similar chassis, but present you with different trade-offs. If you're looking to make presentations on the road, you'll like the Pentium MMX/233-based Actius with its brilliant 11.4-inch TFT screen—the largest in this roundup. The unit comes with fixed 64MB of RAM, a 3.1GB hard disk, a responsive 16.5-mm-pitch keyboard, a well-

situated touch pad, and a built-in VGA port. Thanks to its extra 32MB RAM, it garnered the top Winstone score of this roundup and has a respectable battery life of 2:22. The unit's travel weight is 3.7 pounds and it comes with a built-in 56-Kbps modem. An external floppy disk drive adds a second PS/2 port as well as serial and parallel ports.

The Portégé is a more compact system, better optimized for those who value portability above all. It lasted 3:11 on our battery test—one of this roundup's best times—and comes with a 1.1GB hard disk and the fastest CPU in this roundup, a Pentium MMX/266. It is just 0.5 inches thick and weighs 3.5 pounds ready for travel. Its 10.4-inch TFT screen is sharp, and its 32MB of RAM are expandable to 96MB. The unit has a comfortable 17.3-mm-pitch keyboard, an AccuPoint pointing stick, a PC Card modem and a USB port. For all other ports (save IR), you'll need the port replicator bar, which is included. An external floppy disk drive is also included.

Though we were impressed with the Windows CE units that we saw—particularly the compact \$900 LG Phenom Express and the versatile \$1,000 Vadem Clio, though neither is a standard design—we feel none yet offer the right balance of features, and all are still hampered by limited Windows CE applications and a scarcity of e-mail clients

end users. Some people say these are good low-cost student machines. Perhaps, but they currently lack the robustness to be an individual's only computer.

Windows mini-notebooks aren't standing still. The NEC Ready 120LT addresses one of the biggest advantages of Jupiter devices with its \$1,000 price. Of course, you get lower battery life, and to reach this price Packard Bell NEC downgraded the screen to dual-scan passive matrix and the CPU to a Cyrix MediaGX.

In Japan, Sony is shipping the VAIO PCG-C1, a 2.4-pound system that adds a built-in video camera that moves up and down to the VAIO 505F's typical configuration. It's likely to come stateside later this year. Dell and Fujitsu also have mini-notebooks in the works. Several other vendors hope to push down the weight of their lightest units from 3 to 2.5 pounds, but these will be primarily image systems because they won't be cheap, at \$2,000 and up, and many will sacrifice battery life in order to hit a 2.5- or 2.7-pound system weight.

We found our two Editors' Choices to be generally capable—the Toshiba Portégé 3010CT and the Sharp Actius A100 UltraLite PC. For many mainstream users who don't need bulky 6-pound notebooks, these make more sense.

Windows CE Devices

HP Jornada 820 Handheld PC

StrongARM SA-1100, 8.2" LCD, 16MB RAM, 2.6 pounds. Battery Test: 10:53. CPU Test: N/A. \$1,000 street. Palo Alto, CA; 800-443-1254; www.hp.com; 501 at www.pcmag.com/infolink.

●The HP Jornada 820 Handheld PC, marketed toward business users, is a serviceable, near-notebook-size unit with the longest tested battery life of the Windows CE devices we reviewed. Those users making presentations will like the built-in VGA port; many users, however,

will find the other three Windows CE devices more rewarding to use.

At 1.3 inches, the Jornada—sold retail as well as by mail order—is thicker even than the three ultraportable units in this roundup. It isn't as deep as those units, but its nearly as wide, at 9.5 inches, and nearly as heavy, at 2.6 pounds. The keyboard, though it has 18.1-mm spacing and 11 programmable hotkeys, doesn't have the comfortable firmness of those on the LG Phenom Express or the Vadem Clio. The 6.6- by 4.9-inch dual-scan display, though as large as that on the Sharp Mobilon Pro

PV-5000, is not nearly as clear or as sharp, supporting only 256 colors.

Yet the Jornada does provide ample I/O. It integrates a 56-Kbps V.90 modem, a VGA port, and—unique among today's Jupiter devices—a USB port. Unlike the Phenom, however, it lacks a parallel port. HP designed the primary and backup batteries to be easily removable; they provide nearly 11 hours of life. An optional battery pack is \$200.

HP includes a suite of Microsoft CD apps, a file

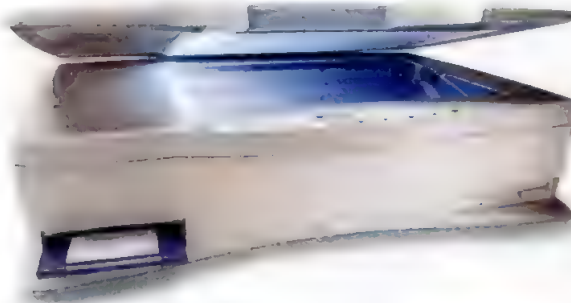


HP Jornada 820: The system includes both a VGA port and a USB port.



Left Field

Way out yonder. Far, far away. Nowheresville. You can now scan and store images anywhere your heart desires with ImageDeck™—Microtek's new Stand-Alone Scanning Appliance™. All you need is a  wall socket and something to scan. ImageDeck is a 36-bit, 600 x 600 dpi desktop scanning appliance that features a 100 MB Iomega Zip® Built-in™ drive, as well as a 3.5" floppy drive. Images can easily be transferred to a PC or a Mac. And if you attach your ImageDeck to a color printer, it doubles as a high-resolution color copier. So no matter where you go, there you are—scanning images and making color copies. For more, see us at www.imagedeck.com.



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Windows CE 3.0 Software Applications

Below is our list of available Windows CE software in commonly used categories. We do not include Microsoft Pocket Excel, Pocket Word, Pocket PowerPoint, and Pocket Outlook, which are typically bundled with each Windows CE system. Visit PC Magazine Online to get one-click access to all of the Web sites shown here.

	Title	Street price	Contact
DIGITAL IMAGING			
Sierra Imaging Inc.	Image Expert CE (digital image viewer; allows edits and file transfer)	Web download, \$50; CD-ROM, \$70	877-446-2439, www.sierraimaging.com
E-MAIL			
PhatWare Corp.	HPC NetProfile (creates TCP/IP profile for devices)	\$15	650-299-0110, www.phatware.com
River Run Software Group	Mail on the Run! (allows remote access to various e-mail programs)	\$90	203-861-0090, www.riverrun.com
Ruksun Software Technologies Pvt. Ltd.	IMAP Force 2.1 (e-mail program)	\$80	888-478-5786, www.ruksun.com
FAX			
Bsquare Corp.	bFAX Express 3.01 (fax transmission)	\$30	888-820-4500, www.bsquare.com
	bFAX Pro 4.0 (fax send/receive; integrates into contact database; allows file transmission)	\$70	
	Print-to-bFax 2.0 (add-on to bFAX Pro for printing of Win CE data)	\$20	
FINANCIAL			
Bsquare Corp.	bTrack (expense tracker)	\$60	888-820-4500, www.bsquare.com
MVA Software Inc.	Proficiency (complete financial and scientific calculator)	\$60	714-970-9147, www.mvasoftware.com
GLOBAL POSITIONING SYSTEM (GPS)			
TeleType Co.	TeleType GPS (includes U.S. map; supports map imports)	\$95 (software only)	888-835-3897, www.telatype.com
HANDWRITING RECOGNITION			
Advanced Recognition Technologies Inc.	ARTRecognition Professional Edition (allows voice as well as handwriting recognition)	\$70	888-762-7845, www.artcomp.com
Communication Intelligence Corp. (CIC)	Jot 2.0	\$66	800-888-8242, www.cic.com
	QuickNotes Pro (recognizes handwritten notes and organizes by date)	\$40	
ParaGraph, a division of Vadem	CalliGrapher 5.2	\$80	888-387-7565 www.paragraph.com
NETWORK CONNECTIVITY			
AvantGo	AvantGo 2.0 (contains server and client components; manages and integrates devices into network; has dial-up and wireless support)	100 users, \$30,000	650-638-3399, www.avantgo.com
FutureSoft Inc.	DynaComm Connectivity Series for the Windows CE OS (DCS) (lets devices access network)	\$100	800-989-8908, www.futuresoft.com
Infowave Wireless Messaging Inc.	Infowave Office Enabler (integrates device into LAN; has wireless support)	\$150 per client	800-463-6928, www.infowave.com
PIMS (PERSONAL INFORMATION MANAGERS)			
PhatWare Corp.	HPC Notes 2.02 (adds headers to notes to organize; interfaces with contact manager; allows e-mail transmission from a note-taking program)	\$60	650-299-0110, www.phatware.com
Symantec Corp.	ACT! for Windows CE 1.0 or higher	\$108	800-441-7234 www.symantec.com
SYNCHRONIZATION			
Puma Technology Inc.	Intellisync for Windows CE 2.1 or higher	\$70	800-248-2795, www.pumattech.com
Rand Software Corp.	Randsoft Harmony '98	\$98	888-726-3763, www.randsoft.com
River Run Software Group	All in Sync! Personal (allows synchronization of calendar and scheduling data with Lotus Notes)	\$88	203-861-0090, www.riverrun.com



LG Phenom: This half-size unit includes VGA, parallel, and serial ports

finder, OmniSolve (a finance program), a backup program, several system management utilities, and an Internet connection wizard (for use with an ISP account). The Jornada comes with serial and modem cables, an 0.7-pound AC adapter, and a one-year warranty.—Cade Metz

LG Phenom Express

Hitachi SH3 7709R, 8.2" LCD touch screen, 32MB RAM, 1.9 pounds. Battery Test: 6:43. CPU Test: 2:35. \$900 street. Englewood Cliffs, NJ; 800-243-0000, 201-816-2095, www.lgphenom.com; 502 at www.pcmag.com/infolink.

LG Electronics offers not only the smallest Jupiter device in our roundup but also the one with the finest keyboard, graphics engine, and I/O hardware, making it a good e-mail, note-taking, or minipresentation device. This true hand-held weighs under 2 pounds (2.5 with AC adapter) and measures 6 inches from front to rear. As a result, the LG Phenom Express display is about half the height of others in this story.

The stunningly clear display is touch-sensitive, as are the nine hard icons that run along the base of the display for quick access to major applications. Measuring 8.2 inches in diagonal, the display is much wider—7.5 inches—than it is high—3.2 inches. The keyboard, though not full-size, is easy to use.

Not only does the unit integrate a 56-Kbps V.90 modem, an infrared port, a PC Card slot, and a serial connection, but also a parallel port and a VGA port. The primary battery is backed up by a small internal battery.

You can use the Phenom as a voice recorder; an external button turns the machine on and launches Microsoft's

Safety deposit boxes.

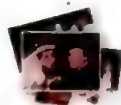


Your guide to personal storage.



A safe place.

There's no feeling like knowing the things you treasure most are safe. Iomega® Zip® disks give you this feeling by providing a safe place to keep some of your most valuable possessions. Zip disks are, in essence, safety deposit boxes. They give you a place to keep digital copies of the things you'd find difficult to replace, such as wedding photos, tax records, personal works of art, or even your kids' letters to Santa. Important work files will also find sanctuary on Zip disks. Use them to back up all your memos, presentations, and other irreplaceable documents. Save it all on Zip disks and know the feeling of security.

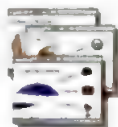


The new Zip® 250 drive and disks are the perfect size for home, work, and everything in between. And it's compatible with the millions of 100MB disks already out there.



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Photographs are some of your most valuable, irreplaceable possessions. And the safest place to keep them are on Iomega® Klik!™ disks—they're like rolls of film for your digital camera. Only better. With 40MB per disk, you can save hundreds of snapshots. And, unlike regular negatives, they're much easier to manage, store and transport. Which also makes them ideal for the business traveler. Backing up important presentations on Klik! disks will save the day when your laptop crashes. They're like little portable safety deposit boxes.



Introducing the incredibly small, highly portable 40MB Klik!™ drive and disks. At a size of just 2" by 2", the disks are perfect for mobile computers, digital cameras, and HPCs.



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With the new Iomega® Jaz® 2GB drive, you can save your life's biggest, most important work. And it's compatible with the Jaz 1GB disks you may already have.

Disaster strikes.

It happens to the best of us. We feel a false sense of security when it comes to saving files on our PCs. Take the Stanford Graduate School of Business, for example. A few months ago, years of academic research was somehow erased from two of their servers—an estimated 10 to 15 faculty and students lost files that were not backed up.¹ The solution? Back up everything on Zip®, Jaz®, and Click!™ disks. End of story.

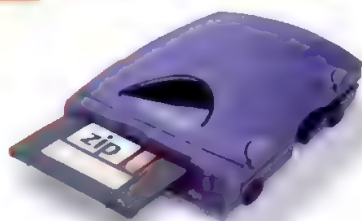


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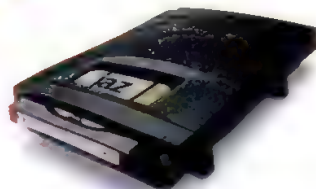


Zip® 100 disk 2-pack	\$29.95
Zip 100 disk 3-pack	\$49.95
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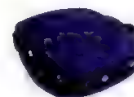
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Sharp Mobilon Pro:
Conveniently, the unit offers ten hotkeys for quick application launch.

Sharp Mobilon Pro PV-5000

MIPS 3922, 8.2" LCD touch screen, 16MB RAM, 2.7 pounds. Battery Test: 7:10. CPU Test: 4,420. \$900 street. Mahwah, NJ; 800-237-4277; www.sharp-usa.com; 504 at www.pcmag.com/infolink.

Among the Jupiter devices in this roundup, the Sharp Mobilon Pro PV-5000 is the leading option for business travelers who will be loading large files. The Mobilon offers a serviceable 6.6- by 4.9-inch display and the round-up's fastest Windows CE CPU. Otherwise, it is generally more limited than its competitors. The Mobilon includes only minimal I/O—no VGA or parallel

port—and does not let you replace or augment the unit's primary battery.

Sold through retail outlets, the Mobilon is a Windows CE device built much like a notebook. Only slightly smaller and lighter than the Sharp Actius A100 UltraLite PC, its LCD screen is comparable to that of the HP Jornada 820 Handheld PC, and its keyboard offers dedicated Home and End keys as well as ten hotkeys for launching oft-used applica-

tions. The display is touch sensitive; a plastic stylus is included.

Sharp integrates a Type II PC Card bay, an IrDA port, a serial connection, and a 33.6-Kbps software modem. The lack of a VGA or parallel port makes presentations or printing on the road more difficult. The unit also lacks a CompactFlash bay and a microphone.

Sharp augments the standard Windows CE software load with its own File Viewer, MPEG player, and Image Editor.

Vadem Clio:
Because its screen swivels, you can use the unit in a variety of ways.



Using a bundled CD, you can also load Bsquare's bFAX Pro 4.0, Bsquare's backup Plus package, several sample MPEG files, and an application for use with Sharp's optional camera card (\$400).

The unit provides roughly 7 hours of battery life, and it ships with a small backup battery, which must be installed on purchase. Sharp includes a serial cable, a modem cable, and a 0.7-pound AC adapter, and a one-year warranty.—CM

Vadem Clio

NEC VR4111 MIPS 4000, 9.4" LCD touch screen, 16MB RAM, 3.2 pounds. Battery Test: 6:39. CPU Test: 2,040. \$1,000 street. San Jose, CA; 888-468-2336; www.vadem.com; 507 at www.pcmag.com/infolink.

The most unusual Jupiter system of our roundup, the Vadem Clio is also the most versatile. This jet-black device is larger and heavier than the other three ultraportables in this roundup and it lacks integrated VGA and parallel ports. However, those using handwriting-recognition applications and those needing a lightweight e-mail and note-taking unit should consider the Clio.

Measuring 1 by 11.3 by 8.8 inches, the

Voice Recorder application. In addition to the Windows CE software, the Phenom loads an Internet connection wizard for use with an existing ISP account, AnyWare Consulting's Pocket Finance, and Bsquare bFAX Pro 4.0. We encountered problems faxing in informal tests, but this problem should soon be fixed. A separate software CD provides a file viewer, an e-mail client, and Citrix's ICA Client.

Backed by a one-year warranty, the Phenom ships with serial and modem cables and an AC adapter.—CM

Ratings

WINDOWS CE DEVICES	Road warrior	Communication	Usability
HP Jornada 820 Handheld PC	Good	Excellent	Good
LG Phenom Express	Good	Excellent	Fair
Sharp Mobilon Pro PV-5000	Good	Fair	Good
Vadem Clio	Fair	Fair	Good
MINI-NOTEBOOKS			
Acer TravelMate 312T	Good	Good	Good
NEC Ready 120LT	Fair	Good	Fair
Sharp Actius A100 UltraLite PC	Good	Good	Good
Sony VAIO 505F	Good	Good	Good
Toshiba Libretto 110CT	Excellent	Good	Good
Toshiba Portégé 3010CT	Good	Good	Good

denotes Editor's Choice. Ratings are comparable only within each category.

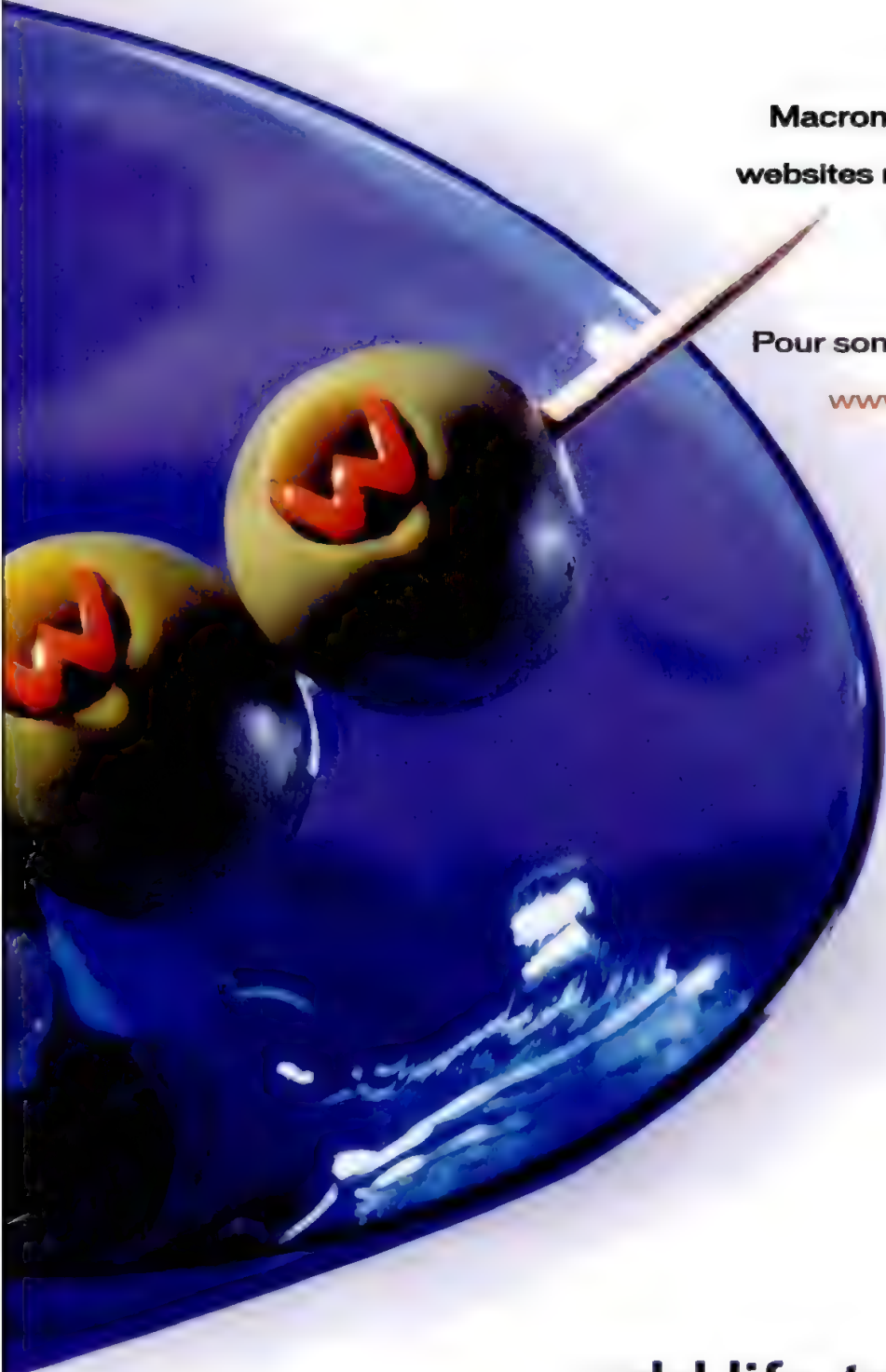
WINDOWS CE

Excellent road warriors are top performers that are lightweight and compact. They also have good screens, comfortable keyboards, fast modems, built-in ports such as VGA and IrDA, and PC Card slots, among other features. Top **communication** units perform at a high level and have fast modems, built-in ports, and PC Card and compact flash slots. To earn **excellent** ratings in **usability**, systems need large, high-resolution LCDs, long battery life, good performance, comfortable keyboards, built-in ports, and top warranties.

MINI-NOTEBOOKS

Excellent road warriors are lightweight, compact units with top Winstone scores. They also have long battery life, good screens, comfortable keyboards, fast modems, large disks, built-in USB and IrDA ports, and PC Card slots, among other features. Top units in **communications** feature high Winstone scores, fast modems, built-in VGA and IrDA ports, PC Card slots, and good LCDs. To earn **excellent** ratings in **usability**, systems need large, high-resolution LCDs, long battery life, good performance, comfortable keyboards, built-in ports, and top warranties.

Build websites with kick.

A close-up photograph of a blue ceramic plate. On the plate are two appetizers, possibly stuffed olives or cherry tomatoes, each with a red 'M' logo inside. A wooden toothpick is stuck into one of them. The background is a plain, light-colored surface.

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BENCHMARK TESTS

Performance Tests



Windows CE devices last three times as long as mini-notebooks do, but unsurprisingly, the Windows CE units' processors are no match for those found in the Windows 98-based mini-notebooks.

Mini-notebooks and Jupiter devices look similar, but they are very different. Tests are comparable only within each group.

With slower CPUs and hard disks, the mini-notebooks are expected to get relatively low scores compared with full-size notebooks. The mini-notebooks currently use Pentium MMX and Cyrix MediaGX CPUs versus Pentium IIs in today's full-size notebooks, and have slow-spinning but thin hard disks (averaging 4,000 rpm versus 4,900 rpm for notebook hard disks).

Among the units tested, the Sharp Actius A100 UltraLite PC earned the top score on Business Winstone, thanks to its 64MB of RAM (its only available configuration); most others had 32MB. Cache sizes made a difference on CPUmark₃₂: The Toshiba Libretto 110CT lacked L2 cache, which resulted in a score nearly 60 percent lower than the average of other Pentium MMX/233 units. Despite 64MB of RAM, the NEC unit's slow Cyrix CPU dragged down its scores on our Winstone and CPUmark tests.

A Jupiter device isn't meant to be a power house, but it is supposed to have a long battery life. Our testing bore out this claim, and the HP system topped the field. With no power management enabled, the devices averaged nearly 8 hours. Running the test with the screen auto-dimmed pushed the life to over 9 hours. This

test represents a constant usage scenario. In typical use where you are turning the device on and off for short periods with power management enabled, the devices should last for several days.

The 148-MHz MIPS 3922 in the Sharp Mobilon Pro PV-5000 bested the rest of the field on our CPU Test, with nearly double the score of its competitors. Because we lacked a compatible version of the CPU Test, the HP unit was not tested. Don't expect even the fastest of these devices to be as snappy as any of the mini-notebooks, however.

How We Tested

We tested the mini-notebooks under Windows 98 and the Jupiter class devices under Windows CE 2.11. Windows CE 2.11 and its applications were still in late beta versions when we tested, which limited our performance tests. Each of the mini-notebooks had 32MB of RAM except for the Sharp and NEC units, which had 64MB. We stripped each system's start-up configuration of all processes or tasks except for Systray, Explorer, graphics-card control panels, and ActiveX controls. We defragmented the mini-notebook hard disks before each test and let Windows 98 manage virtual-memory settings. All tests were run at the LCD's maximum resolution without panning, with 16-bit color.

MINI-NOTEBOOKS

ZD Winstone 99 measures overall system performance and is divided into two parts: **ZD Business Winstone 99**, focusing on mainstream applications, and **ZD High-End Winstone 99**, which emphasizes CPU and graphics-intensive applications performance. We ran only our Business Winstone 99 tests on the mini-notebooks.

The **CPUmark₃₂** score gauges the speed of a PC's processor subsystem, which includes the CPU, L2 cache, and system RAM.

ZD BatteryMark 2.0 measures a notebook's battery life by exercising three 32-bit software workload engines; one each for CPU, disk, and graphics tasks. BatteryMark mixes these workloads and adds periodic *think times*, or breaks, to reflect typical user pauses in work. For testing, we set the hard disk timeout at 2 minutes (or the closest value available), and CPU speed on Auto or Fast.

BatteryMark uses Microsoft Advanced Power Management where possible to automate procedures and provide information.

WINDOWS CE DEVICES

Our **Battery Test** is a constant usage test. We report two numbers: with screen at full brightness and under auto-dim. We left any additional power-management settings at their defaults. We used our ZDigit 2.0 key activator to prevent sleep mode.

We used a **CPU Test** developed by Ed Henning, the director of ZD Labs, Europe. The test produces a single number that reflects CPU performance using integer instructions only. We used similar switch settings for the different compilers needed to produce the test to run on the different processors.

WINDOWS CE DEVICES

High scores are best.

Bold type denotes first place.

	CPU	CPU Test	Battery Test (screen at full brightness) Hours: minutes	Battery Test (screen dimmed) Hours: minutes
HP Jornada 820 Handheld PC	StrongArm SA-1100	N/A*	10:53	N/A**
LG Phenom Express	Hitachi SuperH SH-3	2,355	6:43	7:12
Sharp Mobilon Pro PV-5000	MIPS 3000	4,420	7:28	10:49
Vadem Clio	NEC VR4111 MIPS 4000	2,040	6:36	9:36

N/A*—Not applicable. We lacked a compatible CPU test for the HP unit. N/A**—Not applicable. The product could not perform this test.

▲ **Windows CE devices** The Mobilon's MIPS 3922 CPU led it to the best score of this group and

will help the processing of large files. We couldn't get the screen auto-dim feature to work on this

early model of the Jornada, but its battery life without the screen dimmed topped the competition.

MINI-NOTEBOOKS

High scores are best.

Bold type denotes first place.

✚ denotes Editors' Choice

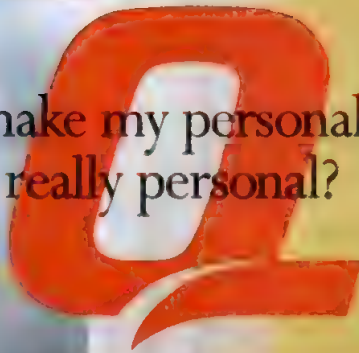
	CPU	ZD Business Winstone 99	ZD CPUmark ₃₂	ZD BatteryMark 2.0 Hours: minutes
Acer TravelMate 312T	Pentium MMX/233	8.4	397	1:59
NEC Ready 120LT	Cyrix MediaGX/200	6.7	224	2:01
✚ Sharp Actius A100 UltraLite PC	Pentium MMX/233	10.2	381	2:22
Sony Vaio 505F	Pentium MMX/233	8.1	411	1:59
Toshiba Libretto 110T	Pentium MMX/233	6.6	253	3:42
✚ Toshiba Portégé 3010CT	Pentium MMX/266	8.3	437	3:11

▲ **Mini-notebooks** If performance is important to you, consider systems with 64MB of RAM,

such as the Actius. Its extra memory proved to be a bigger boost on Business Winstone 99

than the Portégé's 33-MHz processor speed bump up to 266 MHz was.

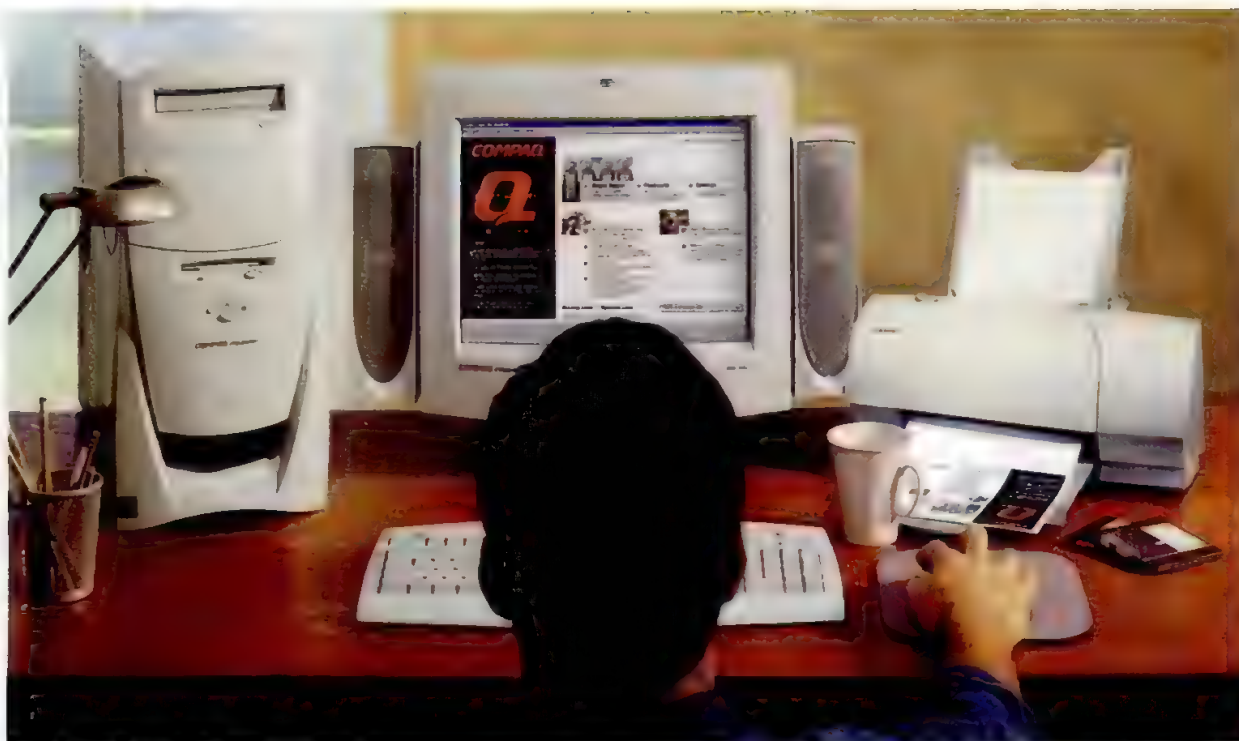
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Compaq Presario 5600-450



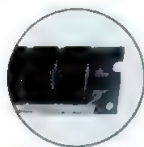
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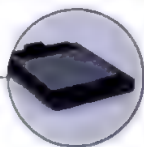
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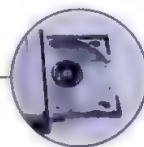
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- Aureal 8820 PCI Audio Card
- 10 Mbps Ethernet Port, Cable Modem Ready
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- Microsoft Windows98
- Compaq V720 17" Monitor (15.9" VIA)

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- 6X DVD-ROM Drive²
- 64 MB SyncDRAM expandable to 384 MB
- 56K ITU V.90 Modem³
- 2X AGP Graphics w/8 MB SGRAM
- Diamond Monster Sound MX300 PCI Audio Card
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Nebraska Mega Mart,
Nobody Beats the Wiz,
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PC Connection, PC Mall,
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- 56K ITU V.90 Modem²
- Smart Lilon Battery
- 512 KB L2 Pipeline Burst Cache
- 256-bit Accelerated Graphics w/2.5 MB VRAM
- Microsoft® Featured Home Collection
- Microsoft Windows®98

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- 64 MB SyncDRAM: Add \$100
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- 2nd-Generation DVD-ROM Drive¹
- 56K ITU V.90 Modem²
- Smart Lilon Battery
- 512 KB L2 Pipeline Burst Cache
- 256-bit Accelerated Graphics w/2.5 MB VRAM
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- 56K ITU V.90 Modem²
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Acer TravelMate: Though its screen is not full-height, the unit features built-in VGA, parallel, and serial ports.

Clio looks like a common notebook—except for the plastic arms on the sides of the unit. These arms allow rotation of the display, so you can use the system as you would a traditional notebook, but you can also rotate the screen, push it down on top of the keyboard, and write on it as you would a piece of paper.

Writing on the Clio's touch screen is done with a stylus. The unit comes preloaded with CalliGrapher 5.2, a very effective handwriting-recognition package from ParaGraph (which was recently purchased by Vadem). CalliGrapher translates your writing—be it print or cursive—into text. You also get Bsquare bFAX Pro 4.0, Vadem ViewFinder, and the standard Windows CE applications.

The unit integrates a keyboard with an

ergonomically curved design, a 33.6-Kbps software modem, an IrDA port, a PC Card slot, a serial connection, and a CompactFlash card slot. The latter cannot be accessed without removing the battery.

Available since the end of last year, the Clio is sold through Vadem's Web site and mail-order catalogs. Vadem also licenses the product to Sharp; it's sold as the Sharp Mobilon TriPad through retail outlets. The Clio, backed by a one-year warranty, ships with a 0.2-pound AC adapter, a serial cable, and a modem cable.—CM

Mini-Notebooks

Acer TravelMate 312T

Pentium MMX/233, 8.4" TFT, 3.1GB disk, 32MB SDRAM, 2.9 pounds. BatteryMark: 1:59. Business Winstone 99: 8.2. \$1,800 street. San Jose, CA; 800-733-2237, 408-432-6200; www.acer.com/aac; 500 at www.pcmag.com/infolink.

With a thicker case, shorter battery life, smaller keyboard, and much smaller display, the Acer TravelMate 312T is not in the same class as the svelte mini-notebooks sold by Sharp and Toshiba. It takes up less horizontal space than such systems, however, and offers a full complement of I/O hardware plus a full-size PC Card bay and a 56-Kbps V.90 modem. It's also cheaper than its competitors: The already-low \$1,800 price includes both a near 2-pound external CD-ROM drive, which

plugs into the PC Card bay, and a 0.8-pound external floppy disk drive.

The TravelMate's 9.3-by-6.9-inch footprint limits the keyboard to 15.2-mm key pitch, and the display to an 8.4-inch (across the diagonal) frame. Otherwise, the keyboard and display are serviceable.

Typically sold to corporate customers, the TravelMate also includes a one-year warranty, a recovery CD, and a simple utility that lets you edit the unit's boot sequence, set its passwords, and change some power-management options.

Keyboard and screen sizes aside, our only major problem with the system concerned power management. As usual, the system supports two P.M. states: standby, a low-power state during which all information is saved to RAM, and hibernation, during which all information is saved to disk and the unit turns off completely. You can set the machine to enter one of these



NEC Ready: Though thicker than most mini-notebooks, this system still has only one PC Card slot.

SUMMARY OF FEATURES

Price of tested configuration For this roundup, all cited prices are street prices, rounded to the nearest \$10.

WINDOWS CE DEVICES

Weight with batteries This weight includes any batteries normally present within the unit; in some cases, this means a primary battery and a secondary or backup battery. This weight does not include any secondary, external batteries.

Installed/maximum RAM and **Installed/maximum ROM** Windows CE devices lack hard disks. All included applications and the OS are stored in ROM, which can be flashed and updated, while RAM is reserved for user files and additional applications.

QWERTY keyboard spacing A full-size keyboard has a standard pitch size—indicating the amount of space from the center of a key to the center of the next key over—of 19 millimeters.

Rated life of standard battery This is battery life as claimed by the vendor or manufacturer. PC Magazine Labs developed a battery test for these units; the results are printed in the reviews and in the performance tests section of this story.

MINI-NOTEBOOKS

System weight/Travel weight The system weight includes all permanently installed drives, the battery, and the modem. The travel weight adds only the weight of the AC adapter and the power cord. External floppy disk drives are not included.

Flash BIOS / Y2K-compliant A flash BIOS is stored on a flash memory chip instead of on a ROM chip, making it cheaper and easier to program and update as needed. Y2K-compliance means that the BIOS has the ability to read the real (correct) date no matter what information it receives from the real-time clock (RTC) on your motherboard.

states, but you can't easily choose which state the machine will enter. To do so, you must reboot to DOS mode, access an application known as Phdisk, and either create or erase a hidden P.M. file. With most machines, you need only enter the BIOS setup to make such a change.—CM

NEC Ready 120LT

Cyrix MediaGX/200, 8" DSTN, 2.1GB disk, 64MB SDRAM, 3.7 pounds. BatteryMark: 2:01. Business Winstone 99: 6.7. \$1,200 street. Sacramento, CA; 800-524-0819, 916-388-0101; www.nec-computers.com; 503 at www.pcmag.com/infolink.

The sub-\$1,000 mini-notebook market is upon us. Packard Bell NEC—which sells PCs through major retail outlets under the Packard Bell and NEC Ready brand names—has introduced the first sub-

THE Computer PAGE.

Working the Web

XML: THE ANNOTATED SPECIFICATION

by Bob DuCharme

With over 170 new usage examples, the leading XML expert explains and annotates the complete official W3C XML specification. Every paragraph of the original spec is dissected—from documents, logical structures and physical structures to conformance and notation. In addition, cross-reference tables and an XML glossary provide easy navigation. (PTR)

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by Jack Davis & Susan Merritt

This guided tour of award-winning Web sites and CD-ROMs offers inspirational ideas and real-world solutions for users at every level. The enclosed CD-ROM includes try-out versions of WYSIWYG and HTML editors and full-version browsers, plug-ins and utilities. (Peachpit Press)

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by John A. Paw & Stephen G. Paw

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by Chris Taylor & Tim Kimmitt

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by Ned Snell

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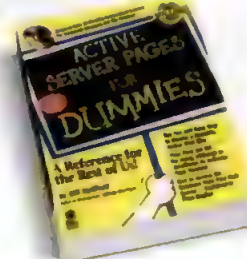
by Bill Hatfield

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by Danny Goodman

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by Sybex

This valuable Internet resource provides beginner and intermediate users with one thousand pages on setting up e-mail, searching the Web and AOL, working with HTML, choosing and installing PCs and modems, plus step-by-step troubleshooting tips. (Sybex)

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SPECIAL EDITION USING HTML 4, FIFTH EDITION

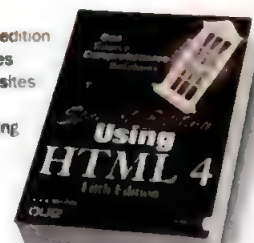
by Molly E. Holzschlag

Clearly defining HTML in its present form, this edition looks at the realities of site design and provides real-life solutions for users creating ambitious sites. Concise language teaches how to implement interactive technology, use practical programming strategies and secure transactions and databases. With CD-ROM. (Que)

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Sharp Actius: The VGA port is built in, but you need the external floppy disk drive for serial and parallel ports.

\$1,000 mini-notebook, the 3.7-pound NEC Ready 120LT (with 32MB; the tested version has 64MB, a \$200 upgrade). This system isn't as thin, light, or fast as the mini-notebooks sold by Sharp, Sony, or Toshiba, but it does offer a keyboard with full-size QWERTY keys and a standard complement of I/O hardware. The biggest drawback, however, is its dual-scan display, which is less sharp than TFT models and measures but 8 inches along the diagonal. As a low-cost, portable, student or budget machine, it holds appeal.

The Ready's bezel is as thick as that of a full-sized portable (1.4 inches) and almost as wide (10.9 inches), yet it is only 7 inches deep. This allows most major I/O ports (VGA, serial, parallel, PS/2, and IrDA), but only a single Type II slot and no USB support.

Even though we tested the unit with 64MB of RAM, it performed well below its competitors under Business Winstone 99, because of the bargain CPU. But it has an internal 56-Kbps V.90 modem, a 0.7-pound external floppy disk drive, and a 1.2-pound external 24X CD-ROM drive with its own dedicated port. The unit's 16-bit Sound Blaster-compatible audio has the best stereo sound of the roundup.

In addition to print documentation, the company preloads the NEC Assistant for quick access to various help tools, a customized Internet connection wizard (with two months of free access on Prodigy or 100 free hours on AOL), and several third-party applications including Microsoft Word 97 and Encarta 98, Quicken Basic 98, MGI PhotoSuite 8, and Iris AntiVirus protection.—CM

Sharp Actius A100 UltraLite PC

Pentium MMX/233, 11.4" TFT, 3.1GB disk, 64MB EDO DRAM, 3.1 pounds. BatteryMark: 2:22. Business Winstone 99: 10.2. \$2,000 street. Mahwah, NJ; 800-237-4277; www.sharp-usa.com. 504 at www.pcmag.com/infolink.



One of our Editors' Choices, the Sharp Actius A100 UltraLite PC is slightly thicker and heavier than the Sony VAIO 505F or the Toshiba Portégé 3010CT, but it offers a larger screen, a reasonable battery

life for its class, and good performance. It is also one of the few to offer a built-in VGA port to ease making presentations.

With a 10.3-by-8.5-inch footprint, the Actius has a smaller screen and keyboard than most full-size notebooks, but its keyboard is responsive, satisfying even the most discriminating touch-typist, while its 11.4-inch LCD is impressive even beside a

desktop monitor. The unit weighs 3.7 pounds with AC adapter.

Built-in, the Sharp provides a 56-Kbps modem, a VGA port, IrDA, a PS/2 jack, and a single PC Card slot. To get a serial, parallel and second PS/2 port, you'll need the bundled 0.9-pound external floppy disk drive. There is no port replicator. Optionally, you can plug a CD-ROM drive (\$300) into the PC Card bay or attach a second lithium ion battery (\$280). You cannot, however, add more memory.

Memory expansion aside, the unit has only two significant flaws: its primary battery cannot be removed without a screwdriver, and any settings changed within its Windows power management interface are not automatically changed within the BIOS (and vice versa). When there is a conflict, the system defaults to the BIOS settings.

Sharp also includes healthy document-

SUMMARY OF FEATURES

Windows CE Devices

■ YES ■ NO	HP Jornada 220 Handheld PC	LG Phenom Express	Sharp Mobilon Pro PV-5000	Vadem Clio
Street price of tested configuration	\$1,000	\$900	\$900	\$1,000
Processor	StrongArm SA-1100	Hitachi SH3 7709R	MIPS 3922	NEC VR4111 MIPS 4000
Dimensions (HWD, in inches)	1.4 x 9.5 x 7.2	1.3 x 9.6 x 5.2	1.1 x 9.3 x 7.7	1.0 x 11.3 x 8.8
Weight with batteries (pounds)	2.6	1.9	2.7	3.2
Installed/maximum RAM	16MB / 32MB	32MB / 32MB	16MB / 32MB	16MB / 32MB
Installed/maximum ROM	16MB / 16MB	16MB / 16MB	12MB / 12MB	24MB / 24MB
External CD-ROM package	None	None	None	None
Integrated serial DB9 port/VGA-out	■ ■	■ ■	■ ■	■ ■
Compact card slot	■	■	■	■
PC Card slots	One Type II	One Type II	One Type II	One Type II
IrDA port speed	4 Mbps	115 Kbps	115 Kbps	4 Mbps
Speaker/microphone/digital audio recorder	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Display				
Resolution	640 x 480	640 x 240	640 x 480	640 x 480
Size (HW, in inches)	6.6 x 4.9	7.5 x 3.2	6.6 x 4.9	7.8 x 6.0
Number of colors	256	256	4,096	256
Keyboard and Pointing Device				
QWERTY keyboard spacing	18.1 mm	16.5 mm	16.0 mm	16.5 mm
Type of pointing device	Touch pad	Pen	Pen	Pen
Touch screen	■	■	■	■
Handwriting recognition software	None	None	None	ParaGraph CalliGrapher 5.2
Communication				
Built-in modem	Hardware	Hardware	Software	Software
Built-in modem data speed (Kbps)	56 (V.90)	56 (V.90)	33.6	33.6
Battery				
Standard rechargeable battery	Lithium ion	Lithium ion	Lithium ion	Lithium ion
Rated life	10 hours	12 hours	8 hours	12 hours
Charging time	4 hours	3 hours	3 hours	3 hours
Service and Support				
24-hour, 7-day live technical support	■	■	■	■
Standard warranty	1 year	1 year	1 year	1 year

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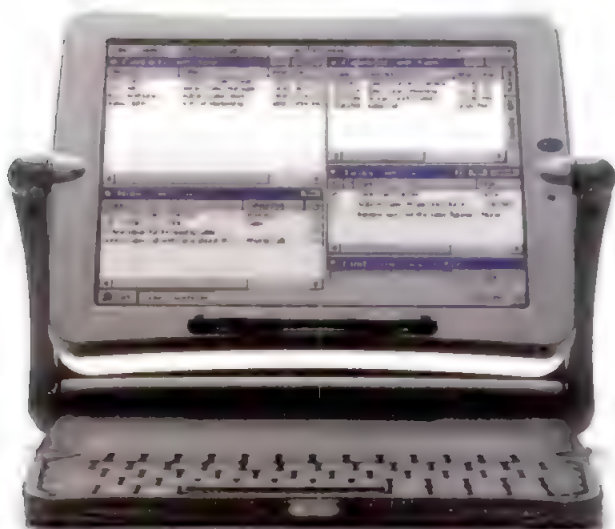
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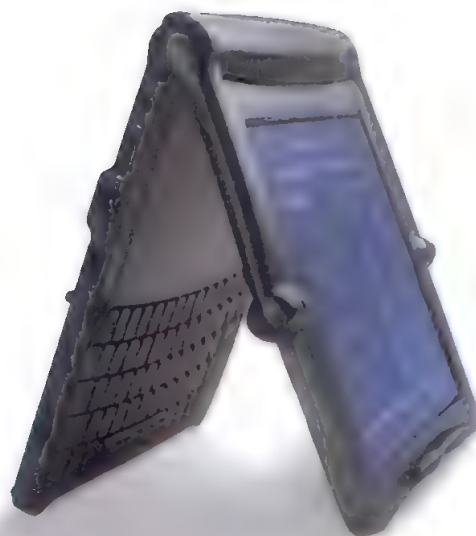
Clio's unique SwingTop™ design by Vadem swings big time with three different configurations. You can use it as a notebook, a presentation tool, or fold it flat and use it as a tablet. Quite frankly, Bob is in awe of this degree of flexibility.



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- > 16MB RAM, upgradeable to 32MB
- > 9.4" 640x480 256-color DSTN display
- > 16.5mm center-to-center keyboard
- > Built-in 33.6Kbps software-based modem
- > Type II PC Card and Compact Flash slots
- > IrDA support
- > 12-hour Lithium ion rechargeable battery pack
- > Rechargeable backup battery
- > Dimensions:
11.25" x 8.75" x less than 1"
- > Full travel weight with batteries and AC adapter:
3 lbs., 5 oz.
- > Bundled accessories: stylus, travel dock, AC adapter

CLIO SOFTWARE

- > Microsoft® Windows® CE, H/PC Pro Edition Software, version 3.0
- > Microsoft Pocket Outlook™ Professional
 - Contacts
 - Tasks
 - Calendar
 - Inbox Professional
- > Microsoft Pocket Office Professional
 - Microsoft Pocket Word
 - Microsoft Pocket Excel
 - Microsoft Pocket PowerPoint
 - Microsoft Pocket Access
- > Microsoft Pocket Internet Explorer
- > ParaGraph CalliGrapher® handwriting recognition
- > Vadem ViewFinder™ screen-based intelligent finder and viewer
- > BSQUARE® bFAX® Pro

PC SOFTWARE

- > Windows CE Services 2.2 with ActiveSync™
- > Microsoft Schedule + 7.0a

SUMMARY OF FEATURES

See www.pcmag.com for interactive views

Mini-Notebooks

	Acer TravelMate 312T		NEC Ready 120LT		Sharp Actius A100 UltraLite PC		Sony VAIO 505F		Toshiba Libretto 110T		Toshiba Portégé 3010CT	
■ YES ■ NO												
Street price of tested configuration	\$1,800		\$1,200		\$2,000		\$1,900		\$1,800		\$2,000	
Processor	Intel Pentium MMX/233		Cyrix MediaGX/200		Intel Pentium MMX/233		Intel Pentium MMX/233		Intel Pentium MMX/233		Intel Pentium MMX/266	
System weight/Travel weight (pounds)	2.9 / 3.5		3.7 / 4.1		3.1 / 3.7		2.9 / 3.4		2.3 / 3.0		2.8 / 3.5	
External floppy disk drive weight (pounds)	0.8		0.7		0.9		0.7		0.8		0.6	
Dimensions (HWD, in inches)	1.4 x 9.3 x 6.9		1.4 x 10.9 x 7.0		1.1 x 10.3 x 8.5		0.9 x 10.2 x 8.2		1.6 x 8.0 x 5.3		0.5 x 10.0 x 8.8	
Installed/maximum system memory	32MB / 80MB SDRAM		64MB / 64MB SDRAM		64MB / 64MB EDO DRAM		32MB / 96MB SDRAM		32MB / 64MB EDO DRAM		32MB / 96MB EDO DRAM	
Installed pipelined-burst SRAM cache	256K		None		256K		256K		None		512K	
Motherboard manufacturer	Acer		Lite-On		Sharp		Sony		Toshiba		Toshiba	
Chip set	Intel 440TX		Cyrix 5520		Intel 440TX		Intel 440TX		Intel 440TX		Intel 440TX	
BIOS	Phoenix 4.0		Phoenix 4.0		Phoenix 4.0		Phoenix 4.0		Toshiba 7.2		Toshiba 7.2	
Flash BIOS / Y2K-compliant	■ ■		■ ■		■ ■		■ ■		■ ■		■ ■	
Display												
LCD-panel size (inches) and type	8.4 TFT		8.0 DSTN		11.4 TFT		10.4 TFT		7.1 TFT		10.4 TFT	
Maximum internal/external resolution	800 x 600 / 1,024 x 768		640 x 480 / 1,024 x 768		800 x 600 / 1,024 x 768		800 x 600 / 1,024 x 768		800 x 600 / 1,024 x 768		800 x 600 / 1,024 x 768	
Maximum internal colors	256		16.7 million		65,536		16.7 million		16.7 million		16.7 million	
Graphics chip set	NeoMagic MagicGraph 128ZV+		NeoMagic MagicGraph 128ZV+		NeoMagic MagicGraph 128ZV+		NeoMagic MagicGraph 128XD		NeoMagic MagicGraph 128XD		NeoMagic MagicGraph 128XD	
Graphics memory	1.1MB DRAM		1.1MB DRAM		1.1MB DRAM		2MB DRAM		2MB DRAM		2MB DRAM	
Storage and Sound												
Hard disk	3.1GB IBM DYKA-23240		2.1GB Toshiba MK2109MAT		3.1GB Hitachi DK237A-32		4.1GB Toshiba MK4309MAT		4.1GB Toshiba MK4006MAV		4.1GB Toshiba MK4310MAT	
Removable/slide-out hard disk	■ ■		■ ■		■ ■		■ ■		■ ■		■ ■	
CD-ROM drive	24X Addonics Technologies Pocket CD II		Optional 24X NEC PC Card Drive		Optional 20X Sharp PC Card Drive		Optional 14X Sony PC Card Drive		Optional 24X Toshiba PC Card Drive		Optional 24X Toshiba PC Card Drive	
MPEG-2 support	Hardware		None		None		Software		None		Software	
Audio synthesis	FM, wavetable		FM, wavetable		FM, wavetable		FM, wavetable		FM, wavetable		FM, wavetable	
Built-in speakers	1		2		2		1		1		1	
Functions of jacks	Audio-in/audio-out		N/A		Audio-out/microphone		Line-in/line-out		Line-out/microphone		Audio-out/microphone	
Communications and Expansion												
Modem	Internal K56flex (V.90)		Internal K56flex (V.90)		Internal K56flex (V.90)		Internal K56flex (V.90)		None		PC Card K56flex (V.90)	
Cellular modem	■		■		■		■		N/A		■	
PC Card slots	One Type III or two Type II		One Type II		One Type II		One Type II		One Type III or two Type II		One Type III or two Type II	
CardBus socket support	■		■		■		■		■		■	
Port replicator/serial port/parallel port	0 / 1 / 1		1 / 1 / 1		1 / 1 / 1		1 / 1 / 1		1 / 1 / 1		1 / 1 / 1	
USB port/shared external keyboard and mouse ports	1 / 1		0 / 1		1 / 1		1 / 0		0 / 0		1 / 0	
IrDA speed	4 Mbps		115 Kbps		4 Mbps		4 Mbps		4 Mbps		4 Mbps	
Miscellaneous												
Key size	15.2 mm		19.0 mm		16.5 mm		16.5 mm		14.8 mm		17.3 mm	
Full-size cursor keys	■		■		■		■		■		■	
Type of pointing device	Touch pad		Pointing stick		Touch pad		Touch pad		Pointing stick		Pointing stick	
Docking station/Port replicator	■ ■		■ ■		■ ■		■ ■		■ ■		■ ■	
Spare lithium battery	\$99		\$69		\$280		\$150		\$170		\$170	
External PC Card CD-ROM	Included		Included		\$300		\$300		\$300		\$300	
Power												
Battery type	Lithium ion		Nickel hydride		Lithium ion		Lithium ion		Lithium ion		Lithium ion	
Charge time while on/while off (hours)	6.0 / 2.5		8.0 / 2.5		2.5 / 2.0		2.5 / 2.0		6.0 / 3.0		6.0 / 3.0	
Standby/hibernation mode	■ ■		■ ■		■ ■		■ ■		■ ■		■ ■	
Service and Support												
24-hour, 7-day support	■		■		■		■		■		■	
Standard warranty	1 year		1 year		1 year		1 year		1 year		1 year	
On-site service charge for one year	Included		N/A		N/A		N/A		\$50		\$50	

N/A—Not applicable: The product does not have this feature.



Sony VAIO 505F: You get an integrated USB port, but you need the port replicator for VGA, serial, and parallel ports.

tation, a recovery CD, and a one year warranty. A \$2,300 model with a 266-MHz CPU, a 4.3GB hard disk, and 2MB of video memory is also available.—CM

Sony VAIO 505F

Pentium MMX/233, 10.4" TFT, 4.1GB disk, 32MB SDRAM, 2.9 pounds. BatteryMark: 1:59. Business Winstone 99: 8.1. \$1,900 street. San Jose, CA; 888-476-6972; www.sony.com/pe; 505 at www.pcmag.com/infolink.

Though its svelte frame is no longer unique, the Sony VAIO 505F is still an appealing option. But it lacks some integrated ports, which may hinder presentation-minded buyers, and its battery life is shorter than those of leading competitors.

The unit's keyboard is conducive to touch-typing, but it offers only 16.5-mm key pitch and fails to match the comfort of the keyboards of the Sharp or the Toshiba systems, or even such Windows CE devices as the Vadem Clio or the LG Phenom Express. The touch pad is correctly situated on an ample palm rest.

Sony integrates a modem, a PC Card bay, a USB port, and an IrDA port into the unit, then ships the system with an external floppy disk drive and a small port bar that provides serial, parallel, VGA, and PS/2 connections. You can also purchase an external 0.9-pound CD-ROM drive (\$300) that plugs into the unit's PC Card bay, but you'll have to add a male-to-male stereo cable as well if you want to play audio CDs. For better sound, you'll need the \$100 Sony VAIO speakers.

The VAIO 505F ships with print and electronic manuals, an MPEG player, 50 free hours of Internet access, Adobe Pho-

toDeluxe, Quicken, and Microsoft Money, Outlook, and Works, plus a front end known as VAIO Space II that eases navigation through Windows' and Sony's help tools. The company provides a one-year warranty, which—be forewarned—is reduced to 90 days if you don't return the unit's registration card.—CM

Toshiba Libretto 110CT, Portégé 3010CT

Libretto 110CT: Pentium MMX/233, 4.1GB disk, 7.1" TFT, 32MB EDO DRAM, 2.3 pounds. BatteryMark: 3:42. Business Winstone 99: 6.6. \$1,800 street. **Portégé 3010CT:** Pentium MMX/266, 4.1GB disk, 10.4" TFT, 32MB EDO DRAM, 2.8 pounds. BatteryMark: 3:11. Business Winstone 99: 8.3. \$2,000 street. Irvine, CA; 800-867-4422, fax: 800-457-7777; <http://computers.toshiba.com>. 506 at www.pcmag.com/infolink.



The Toshiba Portégé 3010CT, one of our Editors' Choices, is a good road-warrior system with a light case similar to the Sony VAIO 505F's but a better CPU and one of the longest battery lives in this class, although it, too, forgoes some integrated ports. The Toshiba Libretto 110CT is a very compact unit with terrific battery life but a small screen and keyboard that most users would likely find too restrictive, although Toshiba claims success in vertical markets requiring very small packages capable of handling Windows NT.

The Portégé weighs under 3 pounds and is only 0.5 inches thick. The Libretto weighs even less at 2.3 pounds, and at 1.6

by 8.0 by 5.3, it fits easily into a knapsack. This small size doesn't compromise speed and performance: Both units pack powerful CPUs, ample hard disks, and enough system memory and good graphics accelerators for browsing the Web and working on documents and presentations.

The two units have external floppy disk drives, IrDA ports, and two PC Card slots each—and with a port replicator bar, have all other necessary ports; but for presentations or printing, you'll need the port replicator. An included PC Card modem and the comfortable though not full-size keyboard make the Portégé robust enough to be your primary computer.

The Libretto is more limited, not in power but in user comfort. Its small size makes typing harder, and its pointing device and buttons reside to the right of the display screen; a cumbersome setup for touch-typists or left-handed users.

Both units come with Microsoft Outlook; Puma's IntelliSync 97; and Toshiba Utilities, a Windows environment for setting up hardware, power management features, and other items such as battery alarms, without having to go into the BIOS. With the Portégé, you also get a business-oriented software bundle that includes Intel LANdesk Client Manager 3.3. Toshiba backs these units with a one-year warranty and toll-free technical support. After the year, each call is \$35, but the Web site provides comprehensive user manuals.—Angela Tuka **PC**

Libretto 110CT: The unit's pointing stick and buttons are uncomfortably located on the screen panel.



Portégé 3010CT: There are two PC Card slots (one for use with bundled modem) but no ports.

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May 26, 1998
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"Color laser printers have now become affordable enough that some small offices can deploy one as their only shared printer. None exemplify this more than our Editors' Choice in this category, the QMS magicolor 2 CX."

— PC Magazine, May 1998

Best Overall —
The QMS magicolor 2 CX

"QMS's relatively low-cost magicolor 2 CX makes a clean sweep in all categories, including best-overall, best-quality, and best-value color laser printer."

— BYTE Magazine, April 1998

The Best Business Printer —
The QMS magicolor 2 CX

"The QMS magicolor 2 CX speeds along at 4 pages per minute in full color—16 ppm in black and white—providing unprecedented performance in an under \$4,000 color laser printer."

— Macworld Magazine,
January 1998

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PC Sound: BETTER ALL AROUND

From three-dimensional sound to audio-friendly interfaces, the way your PC processes audio data is changing for the better. We take a look at the progress and compare the leading 3-D sound technologies.

Audio is hot. Although the three-dimensional gaming delivered by the newest graphics accelerators has garnered much of the attention, PC audio has been evolving at a frenetic pace as well. The result is immersive, high-quality sound that brings the game experience to life and makes button-down applications such as videoconferencing and voice-recognition more user-friendly.

The changes in PC audio are coming on four fronts:

- **Positional audio.** Hardware-assisted 3-D sound-processing algorithms create a more realistic sound field that envelops the listener. Multichannel audio, meanwhile, allows the use of several speakers to mimic a home-theater experience.

- **Improved sound quality.** Intel, Microsoft, and others are getting tougher on accepted noise and distortion levels, so the audio produced by a typical PC will rival that from a home stereo.

- **Debut of USB audio.** The Universal Serial Bus shows promise as a connection point for speakers that take care of most of your PC's audio processing, eliminating the need for a sound card in some setups.

- **March to PCI.** PC makers are phasing out the ISA bus and hence ISA-based sound cards, as PCI audio solutions gain prominence.

Should you care? If you use your PC's sound system simply to play music CDs while you work, you're already benefiting from advancements that put the audio

By
Will Pirkle

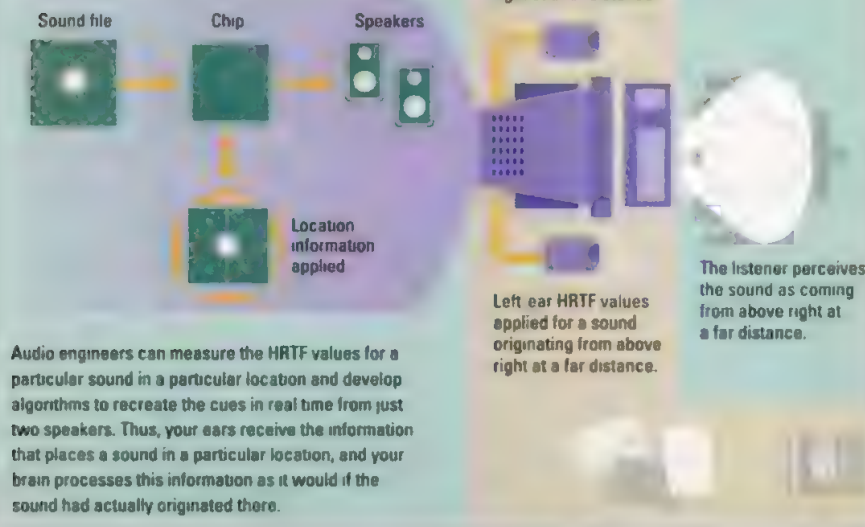
▼
Ken C. Pohlmann



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Mimicking How Humans Hear

We perceive the location of a sound source based on a number of complex yet subtle auditory (and visual) clues. For instance, a sound that originates on our right reaches the right ear milliseconds before it reaches the left (interaural time delay). In addition, the timbre and volume of the sound are different on the left as the sound travels around the head and is reflected off the torso and funneled by the outer ear (interaural intensity difference). These effects are cumulatively known as head-related transfer functions, or HRTF.



quality on a par with an entry-level home stereo equipment. If you're a gamer or DVD video fanatic, 3-D-enhanced audio is a must (and the more speakers, the better). In business, USB audio is intriguing for its quick connectivity, while positional audio will take center stage for videoconferencing applications.

3-D SOUND: THE NEW FRONTIER

Positional audio (also called 3-D audio) is the hottest item in PC sound today. Born of movie parents, 3-D sound envelops the listener, enhancing the realism of any sonic environment. Computer game playing is greatly enhanced with the addition of positional audio, as the sound cues help the player get a proper fix on the location of the next target. In fact, almost every hot title now supports one or more of the 3-D codecs.

But games are not the only outlet for

3-D audio. In the business arena, videoconferencing is a natural fit for 3-D-enhanced sound. One of the problems with videoconferencing is that there are usually multiple participants on both ends of the camera. The video feeds are compressed, so the images change very slowly, making it difficult to tell which person is speaking. And if several people speak at once, the resulting cacophony can be annoying or even unintelligible. The use of 3-D audio lets each video participant appear in a unique sonic location in the recipients' room, so the conversation is easier to follow.

Home theaters use a brute-force approach to 3-D audio, literally surrounding the listener with speakers in what's known as a 5.1-channel setup: left and right front channels, left and right rear channels, a center channel, and a subwoofer (the "dot-one"). And indeed, there are PC sound cards (the \$200 Cre-

ative Labs Sound Blaster Live!, for example) that offer multichannel output for use with speaker systems that offer four or more satellite speakers (such as the \$200 AudioStorm MT7 from Gallant Computer and the \$300 Cambridge SoundWorks Desktop Theatre). Such systems are able to deliver true Dolby Digital (formerly called AC-3) surround sound, prevalent in DVD-based movie and game titles.

These approaches deliver the most believable 3-D sound experience, but for most PC users, space and expense considerations prohibit the addition of more speakers. Enter a spate of 3-D sound algorithms and APIs that aim to place sonic images anywhere in a sphere surrounding the listener, using only two speakers. New sound cards from Creative Labs, Diamond Multimedia, Turtle Beach, and Aztech support one or more of these APIs. Many new PCs also include 3-D audio in the box, either through one of these add-in cards or via chip sets from Cirrus Logic, Crystal Semiconductor, and others.

How can we produce a sonic image that appears to emanate from behind the listener using speakers located in front of the listener? The secret lies in *psychoacoustics* and the way the ear and brain perceive the directionality of sound. In particular, the ear and brain pick out specific cues that make the determination. Stereo systems can mimic these cues—*interaural time difference* (the arrival-time difference between the ears), *interaural intensity difference* (the intensity or amplitude difference between the ears), and *pinnae filtering* (the effect of the outer ear on sounds entering the ear canal). By placing these cues into stereo channels, a system fools listeners into believing that the sound is coming from somewhere other than the two speakers in front of them.

Such trickery, however, requires intensive mathematical calculation for the filtering of sounds in real time. For this reason, the major 3-D audio systems require processors located on a sound card or (in the case of motherboard-resident audio) a specialized audio chip with advanced DSP (digital signal processor) features. For the section that follows, "3-D Sound Technologies: How Do They Compare?", we tested the major solutions from Aureal, Creative Labs, Microsoft, QSound Labs, Spatializer, and SRS Labs.

Our Contributors: WILL PIRKLE and KEN POHLMANN are professors of music engineering at the University of Miami School of Music. DON LABRIOLA is a frequent contributor to *PC Magazine*. JEFF SACILOTTO and S. JAE YANG were the project leaders, and JAMIE M. BSALES was the senior associate editor in charge of this story.

CLEANING UP PC AUDIO

But what good is 3-D sound if the sonics are noisy and harsh? Thus another thrust in PC audio is the move to provide clean, clear audio that is free of PC-induced noise and distortion.

The inside of a PC an inhospitable place for high-quality audio. The high-speed buses and clocks, with the electromagnetic noise they radiate, are anathema to the subtly quiet world of audio. The Audio Codec '97 specification certainly improved on a bad situation by segregating the digital portion of the audio system from the analog portion. Whereas ISA systems lumped PC and audio chips together—leading to the noise and distortion typical of old-style PC audio—AC '97 called for a digital chip on the bus itself (with control and processing for features such as equalization, reverberation, and mixing) and an analog chip off the bus and near the I/O connectors (for interfacing and conversion). Hence, AC '97-compliant machines deliver signal-to-noise and frequency response figures that match low-end home audio components.

But AC '97's real contribution may lie in its provisions for Universal Serial Bus (USB) and high-speed FireWire (IEEE 1394) interfaces. That's because even better audio results can be obtained by moving the analog audio circuits out of the PC entirely, and the USB and 1394 specifications accomplish exactly that. USB and 1394 are flexible interfaces that permit interconnecting all kinds of peripherals to a PC and to each other. Moreover, they are almost ideal for conveying audio data, especially the multichannel variety.

Would you rather connect a wad of audio leads to your PC or one wire that carried the audio data directly to the loudspeakers? The latter is exactly what USB speakers (from Altec-Lansing, Labtec, Microsoft, Philips, and others) provide. The all-important digital-to-analog converter is located inside the speaker—along with the power amplifier—so it is far from the PC's internal noise. All of the appropriate digital processing (such as equalization) takes place upstream in the PC and is placed on the 12-megabit-per-second USB connection as *isochronous data*: packetized transfers with guaranteed pro-

toloc time slots for smooth playback. Then the USB speaker reproduces the encoded signal, creating the appropriate sound field. Alternatively, the USB speaker could accept a raw audio stream and do all its own processing. But note that *USB audio streaming*, as the process is called by USB speaker vendors, requires Windows 98 or NT 5.0 and a fast CD-ROM drive that can extract digital audio data directly off the disk. (See the sidebar "USB Audio: Ready Yet?" for our take on the current state of the art.)

The 1394 interface is even more audio-friendly than USB. For starters, its 100-, 200-, and 400-Mbps transfer rates are well suited to the fast rates of high-quality multichannel sound. The 1394 specification includes the Audio and Music Data Transmission Protocol (known as the *A/M Protocol*), which defines how digital audio can be conveyed over 1394 using isochronous packets. This protocol and

forthcoming multichannel versions will provide plenty of bandwidth to move forthcoming DVD audio-data streams.

And audio quality should improve beyond the minimum specs laid out by AC '97. The PC '99 specification, Intel's blueprint for PC designers, raises the bar on the noise and distortion levels permissible in a compliant PC.

ISA'S LAST GASP

The PC '99 spec also banishes audio from the ISA bus. As we reported last year ("The Shifting Soundscape," January 6, 1998), the greater bandwidth of the PCI bus enables the multichannel processing needed for the newly resource-intensive positional audio. In fact, to earn WHQL (Windows Hardware Quality Lab) certification—and the right to wear the Windows logo—a new PC cannot have an ISA bus at all (though a "refresh" of an existing layout can still have it). ISA audio

USB Audio: Ready Yet?

We've begun to see many USB devices emerge, thanks to much improved USB support under Windows 98. USB was designed to simplify PC upgradability and improve data integrity by providing a standard expansion architecture and digital transport of data to peripheral devices—mice, keyboards, joysticks, trackballs, scanners, and so on. Why USB speakers? Proponents state that USB-based audio subsystems won't require sound boards or motherboard-based audio chips and that audio quality is much improved because audio remains in digital form until it reaches the speakers.

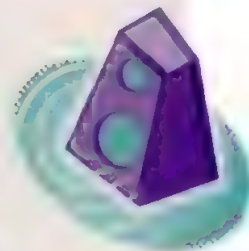
Indeed, when we didn't stress the systems, we found the audio quality of CD music and some DirectSound-enabled games fantastic. We could actually sense a clearness to the sound not present in similarly priced analog speaker systems.

But we experienced a range of problems—from installation hassles to pops and clicks in playback—that were flat-out unacceptable. For example, simply

opening Explorer, accessing the floppy disk drive, or opening large files caused hiccups in playback on some systems. We also found instances where the USB subsystem failed to initialize properly when the speakers were hot-plugged in; a few times this resulted in system lockups. But the most frustrating problem affected desktop systems with a Phoenix BIOS. These systems wouldn't boot when the USB speakers were plugged in. We had to boot the system first, then plug in the speakers.

Moreover, current USB audio solutions don't compete with current PCI sound cards for high-end gaming use, where the processing of multiple DirectSound audio streams and hardware acceleration of 3-D sound is becoming more important.

Once the problems are ironed out, USB speakers will be attractive. But at this juncture, we can recommend them only to people who want to experiment with new technology.—Nick Stam



solutions will live on for a few more years in emerging countries, where the Windows logo is less important than the bottom-line cost of the machine. For the time being, an ISA card is still marginally cheaper than a PCI card. But this year and beyond, PCI solutions will outsell ISA solutions.

What are the challenges for the future of PC audio? Beyond improving 3-D and USB implementations, voice recognition

is the next hurdle. Today's somewhat fussy voice recognition systems work best when the user wears a headset, which helps eliminate the variables of amplitude and extraneous noise picked up by standard PC microphones. But no one wants to be tethered to a PC while working. Future audio DSPs will be intelligent enough to recognize the intended speaker within a given range from the mike and throw away extraneous data.

3-D SOUND TECHNOLOGIES

HOW DO THEY COMPARE?

Comparing 3-D sound technologies can be trickier than it looks. Hard-to-control environmental factors easily influence output quality. Even worse is that the industry has yet to agree even on the definition of 3-D sound. Positional-3-D audio systems make moving sounds anywhere in three-dimensional space possible, but other types of "3-D" processes simply add breadth or extra channels to conventional stereo signals. Sometimes the only way to decide whether 3-D technologies will deliver the effect you want is simply to sit down and listen to the output.

So we did. We tested the leading 3-D sound APIs and rendering engines—Aureal's A3D 2.0, Creative Labs' EAX 2.0, Microsoft's DirectSound3D, and QSound Labs' Q3D 2.0—on leading sound cards from Aztech, Creative, Diamond Multimedia, and Turtle Beach. Note that these technologies are also available on cards from other manufacturers and also in many new PCs via chip sets from Cirrus Logic and others (check the box for a list of supported algorithms). We also tested the popular stereo-expansion algorithms from Spatializer and SRS Labs, which appear in a range of sound card and speakers.

3-D ALGORITHMS: DS3D, EAX, A3D

Microsoft's **DirectSound3D** (or **DS3D**) API establishes a standard way for programmers and users to position WAV files in three-dimensional space. The DS3D instruction set provides tools for manipulating up to 32 WAV files at a time, but a 3-D sound-rendering technology is necessary to translate these commands into a true 3-D

sound field. One of the first vendors to offer such a rendering engine has been QSound Labs, which markets the **QMSS** process for multichannel playback systems and the two-channel **Q3D 2.0** technology for stereo speakers or headphones. Both are scalable solutions that can be implemented with or without hardware acceleration.

We listened to Q3D 2.0 and QMSS on a VLSI Thunderbird 128 audio-processing chip installed on a prerelease version of the Aztech Labs PCI 368DSP sound board (www.aztech.com.sg). In addition to running demos and entertainment titles, we subjected both algorithms to Ziff-Davis's new benchmark test suite Audio WinBench 99, which evaluates 3-D-positioning capabilities by asking listeners to identify the motion of sounds moving in three-dimensional space.

We used similar procedures to test Aureal Semiconductor's A3D 2.0 and Creative Labs' EAX (Environmental Audio Extensions) technologies that provide additional functionality by supporting proprietary supersets of the DS3D API.

Based on state-of-the-art NASA research, **A3D 2.0** is arguably the most sophisticated 3-D positional algorithm on the market. It incorporates a unique *Wavetracing* function, which works much like the ray-tracing engines that drive many 3-D graphics-rendering programs. The Wavetracer creates a physical model of an acoustic environment that includes information about the reflective properties of each surface and the position of every sound source and listener. It uses

this data to generate sound waveforms on the fly by calculating the paths they'll take to reach a listener's ears.

Not surprising, A3D 2.0 requires the processing power of Aureal's new Vortex 2 sound-rendering chip set. But it's also smart enough to revert automatically to a highly optimized, software-only A2D mode (which supports A3D 1.x functionality) on machines that lack hardware acceleration (though you sacrifice advanced effects such as Doppler modeling, reflection, and occlusion). In our hands-on evaluation, we tested the algorithm on a Diamond Monster Sound MX-300 card (\$100 street; www.diamondmm.com) equipped with a Vortex 2.

Creative Labs' **EAX 2.0** isn't as advanced as A3D under the hood, but it compensates by packing in a huge assortment of proprietary sound-enhancement features. In addition to the ability to position 64

MICROSOFT'S DIRECTSOUND3D

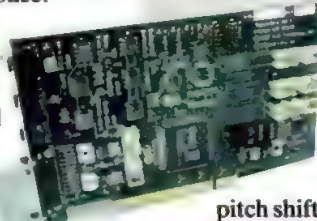
The DS3D API is a set of functions that application programmers can use to add 3-D audio effects to any audio content.

Advantage:

Processing can be done on the host CPU, so no additional hardware is needed.

Our Take:

The implementations we've heard have been unremarkable: There was some front-to-back imaging but no vertical sound placement.



sounds in 3-D space, it provides a large selection of customizable effects (reverb, chorus, pitch shift, and so on) that the user can select from an auto-hiding toolbar. It also includes dozens of preset acoustic environments tuned for two-speaker, multichannel, or headphone listening. EAX's extended features require a hardware accelerator, such as the E-Mu Systems EMU10K1 DSP chip, but EAX-encoded titles can also produce standard positional 3-D sound from any DS3D renderer. During our hands-on evaluation, we ran the algorithm on the EMU10K1-based Creative Labs Sound Blaster Live! card (\$200 street) and SoundBlaster Live! Value Edition card (\$100; www.sblive.com).



FOCUS ON YOUR CUSTOMER

Customer-focused, customer-driven. Over the past decade, the giants of Corporate America have made the customer their strategic centerpiece, investing huge sums in information technology to help them improve their customer relationships.

And, what they've been saying is, 'We have to start treating our customers like small businesses do...with the same personal attention to their needs and the same ability to customize a product or a service.'

While big businesses are using technology to play catch up with companies with one, five, ten, or 20 employees, small businesses all over the world are finding out they can use those same solutions to build their advantage.

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Software solutions can help small businesses serve their customers better than ever, while at the same time helping them improve their own productivity. There are software solutions that not only put the power of information technology at their fingertips, but also protect customers from the problems that systems can cause.

Symantec has spent nearly two decades providing such solutions to individuals, businesses and other institutions around the world, making them more productive and keeping their computers safe and reliable — anywhere, anytime.

"With such revolutionary developments as corporate downsizing, computing and the Internet, the number of small businesses around

you more touch and feel when it comes to your customers?

Understanding

Customer-driven means that a business offers its customers products and services they really need, rather than presenting "a product in search of a market." The price is right; the packaging and shipping is the way they want it; their operation is 24 hours a day, so your support is too. The best businesses are the ones that understand their customers well enough not only to see all this, but also to see what's coming around the bend.

It's never been an easy task. You need to know your customer base by market or geographic segment, but that's not enough. You need to

tools can help you maintain the professionalism and personal touch you've been known for, reminding you and your staff about important customer dates and events.

Responsiveness

Responsiveness on a day-to-day basis says you provide customers with the answers they need when they need them. So sales and service people — no matter where they are — must have instant, easy access to customer databases and the ability to transmit quotes, presentations, and even training programs to customer sites. Access can also be speeded by technology that, for instance, enables caller ID to bring up the record before the sales or service person says "good morning."

It doesn't matter what information your customer needs and how fast, there's a communication vehicle for getting it there and you have to use it all: e-mail, voice mail, fax, overnight delivery. For instance, computer-to-fax is the fastest way to get your customers hard copy. We're talking about hard copy you send from your computer that might contain a just-assembled combination of the latest promotions and product illustrations.

Further, your customers should be able to access your systems to obtain the same information via e-mail or "fax on demand."

Voice mail? It's your image, they say, and technology exists for any size company to make sure you sound right, respond quickly, and keep a record of calls and faxes.

Productivity

Being able to provide your customers with better products and ever higher levels of service, being

Be understanding, responsive, productive and protective. This is what being customer-driven is all about.

the world has exploded," says Symantec's Dana Siebert, VP, Americas. "This is great because small businesses have always been a major source of innovation and service. A primary goal for companies like ours has to be to help level the playing field for them and contribute to their growth.

"What we're saying here is they have an advantage — their understanding of and responsiveness to their customers — and we think we can help them keep it."

The Touch and Feel of Technology

What does it mean to be customer-focused and customer-driven? How can technology give

know your customers individually and they need to feel that you do — that you know their business, you know them as people.

For instance, to create winning proposals over and over again, you want your customer's plans and the history of your relationship at your fingertips. We're not only talking volume, credit history, and the bottom line, but also the nuances of how you have worked together.

Technologically, both the top-down planning and the individual interaction require a customer database: an information file on your customers and their accounts — the notes, the phone discussion logs, the presentations and proposals.

As your company grows, software

FOR MORE INFORMATION VISIT US ON THE WEB AT

able to develop and retain close relationships with individual customers as your customer base grows — all this carries a cost to your business. You can't stay customer-driven as we've described if your resources are strained and your bottom line suffers.

The technology solutions we've noted above — the customer and prospect database, word processor, e-mail messaging and other communications tools such as computer-to-fax and the calendar — are also crucial productivity tools for your organization, allowing them to be responsive to customers literally at the push of a button.

To improve ease-of-use, while safeguarding your investment in new and older computing equipment, such tools must operate on all major computing platforms.

These tools are win-win solutions for the front lines of your business — the people who plan and deliver what the customer needs. You also need technology that protects your business and your customer's, and solutions exist for your back office to provide these safeguards.

Protection

Flash...computers are vulnerable and fallible. They crash, wiping out that 10-page proposal you hadn't saved. They can get viruses. Installing new programs can mess up your system. Worse, you can wipe out data on your customer. And, electronically connected to your customers, you can send them a virus that wreaks havoc on their systems.

The good news is that technology solutions exist to fend off these problems.

Small Business Solutions



ACT!™ turns contacts into relationships and results. This customer and calendar management software provides instant access to critical information about your customers and appointments and triggers on-screen alerts to remind you of important dates. ACT! supports Internet and e-mail access and lets you share information with your team.



WinFax PRO™ gives you immediate faxing right from your computer, allowing you to send professionally-quality faxes, including material from your ACT! database, to one or more customers. You can also economize by scheduling faxes for off-peak hours. WorkGroup Fax Sharing enables WinFax Pro to share its modem and phone lines with other WinFax PRO clients on the network.



TalkWorks PRO™ means a more professional image for small businesses with up to five employees. This voice and fax communications software provides fax-on-demand, enabling your customers to dial your computer and listen to hours of promotions, price sheets, and other information. Away from your office? TalkWorks PRO will call you with messages or collect numbers. Other features: multiple mailboxes and call management, tracking all calls and faxes.



pcANYWHERE™ helps you keep building customer relations when on the move. From your field office in Detroit, you can carry on electronic sessions with your customers in New York, sending them training programs or presentations from your laptop or the corporate computer in Chicago. Naturally, pcANYWHERE lets you access customer data at the home office. Many security features are built in.



Norton AntiVirus™ eliminates today's and tomorrow's viruses. Norton AntiVirus is the best protection for you and any customers you are connected to electronically. PC Magazine, in giving this product the Editor's Choice award this year, called it "the best combination of virus protection, performance, and usability." Testing laboratories confirm that it provides 100% detection of "in the wild" viruses from any source, such as the Internet, floppy disks, and shared files.



Norton Utilities™ provides unrivaled problem-solving power and control by detecting, repairing, and interrupting most computer problems. A trusted solution for more than 15 years, Norton Utilities continuously monitors your system so you don't have to guess which utility to launch when there's a problem. Worried about crashes and disaster-recovery downtime? As PC Magazine has stated, Norton Utilities is "the industry leader" in protecting against crashes—three times as effective as competitors—and provides advanced disaster-recovery capabilities.



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AUREAL'S A3D: BEST OF THE BUNCH

On our two-speaker test system, Q3D 2.0 generated unremarkable DS3D output. Audio WinBench revealed some front-to-back imaging, but there was virtually no vertical sound placement.

Creative's EAX delivered somewhat more realistic 3-D positional effects, producing slightly better front-to-back imaging than Q3D 2.0. Up/down movement was ambiguous, though we found that EAX audio could sometimes produce the illusion of vertical motion when accompanied by 3-D animation.

The best of the lot using two speakers was A3D 2.0, which generated passable right/left, front/back, and even up/down imaging. It produced a rich, spacious three-dimensional sound field and, when combined with the appropriate graphics, created a convincing illusion of a real-world acoustic environment.

None of the technologies were able to position sounds convincingly behind our heads. This changed when we hooked up the second pair of MicroWorks speakers and switched to multichannel versions of each algorithm. A3D, EAX, and QMSS all produced horizontal and vertical imaging much like what we'd heard during the two-speaker tests. But front/back localization was another story; in all three cases, the sound field expanded to fill the space behind our listening positions, and

we found ourselves enjoying true 360-degree sound for the first time.

STEREO EXPANSION: SRS, SPATIALIZER

The first 3-D sound technologies were not the positional-audio schemes such as A3D and EAX; rather, they were less complex stereo-enhancement algorithms, which add depth and spaciousness to any digital or analog source material. By introducing subtle tonal colorations, volume changes, and time delays, these technologies expand the stereo image so that sounds appear to originate from an area extending well beyond the physical locations of the speakers.

One of the best-known such algorithms is SRS Labs' **Sound Retrieval System** (or **SRS**). Ported to more than a dozen sound chip sets and soon to be released in a software-only version, SRS has been incorporated into products as diverse as sound boards, electronic pianos, car stereos, and multimedia speakers. We tested SRS on a Turtle Beach Malibu Surround 64 sound board (\$100 street; www.tbeach.com).

For the most part, SRS performed as billed, dramatically broadening the sound field and synthesizing credible stereo output from monophonic source material. But it also produced significant changes in volume and balance and smeared the stereo image, so that we had trouble precisely locating sounds in more complex arrangements. Worse yet, it generated quite a bit of noise, a problem that may have been aggravated by SRS's habit of boosting upper-midrange frequencies.

Another stereo-enhancement technology is Spatializer Labs' **Spatializer 3-D Stereo**, which has been integrated into a variety of chip sets and motherboards, as well as into software applications such as multitrack-recording programs. We tested it on a vendor-supplied external module that is designed to be inserted between the speakers on your

computer and the line-out jack.

Spatializer 3-D Stereo produced output much like that of SRS. In our testing, it certainly increased the breadth and spaciousness of both mono and stereo source mate-

CREATIVE**LABS' EAX 2.0**

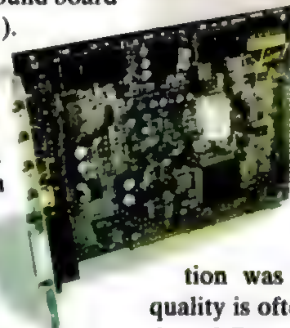
Creative hopes this API will pick up where its Sound Blaster technology left off and become the new PC audio standard. The API is hardware-dependent, requiring the E-Mu EMU10K1 chip.

Advantage:

EAX supports both the DirectSound3D and A3D APIs, and it lets developers add custom effects the others don't have.

Our Take:

EAX delivered somewhat more realistic 3-D positional effects than DS3D alone, producing slightly better front/back imaging. Up/down movement was ambiguous, though we found that EAX audio could sometimes produce the illusion of vertical motion when accompanied by 3-D animation.



rial, but it also muddled the image, distorted higher-amplitude signals, and significantly altered volume levels and left/right balance.

Our bottom-line reaction was mixed. Although output quality is often implementation-dependent, 3-D stereo enhancement can be an inexpensive way to generate good-sounding two-channel output from mono sources. It can also add impact to relatively simple stereo recordings, such as solo instrumentals, and is especially effective when used with low-end speakers. But it's not always as compelling with more complex source material.

Despite recent advances, 3-D audio is still in its infancy. Stereo enhancement remains an entry-level technology, as most positional algorithms do only a fair job of positioning sounds in three-dimensional space, and no 3-D process can yet extract convincing 360-degree sound from stereo speakers. Nonetheless, recent offerings such as A3D 2.0 hint at a day when computer sound will rival that of big-screen movie theaters. The best is yet to come.—Don Labriola **PC**

AUREAL'S A3D 2.0

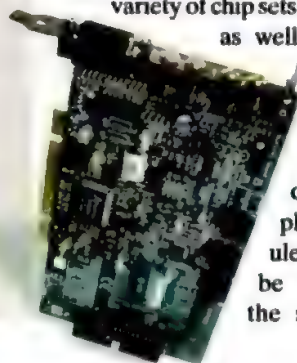
The current front-runner among game developers, this API uses HRTFs to recreate multidimensional sound in a two-channel format. The system requires the Vortex 2 DSP chip.

Advantage:

A3D is well-suited to a two-speaker PC environment. Although you need the company's Vortex 2 chip for best results, the system is smart enough to revert automatically to a highly optimized, software-only A2D on machines that lack acceleration.

Our Take:

The best of the lot. A3D 2.0 generated passable right/left, front/back, and even up/down imaging. When combined with the appropriate visual clues, it created a convincing illusion of a real-world acoustic environment.



Berlin?

Beijing?

Bimini?

Barstow?



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impairments to deliver increased V.90 modem performance; and the unique XJACK® connector, which eliminates the need for extra cables.

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Networking

Three Ways to Use Remote-Access Servers...

REMOTE CLIENTS CAN DIAL IN TO THE SERVER ►

Remote users dial in over direct ISDN or phone lines in order to gain access to servers on the head-quarters' or central office's LAN. This lets users check e-mail, access files, and transfer files between a local PC and the LAN.

REMOTE-ACCESS SERVERS

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You mean, a product that lets me work at home as if I were sitting at my desk? The chance to trade in my pin-stripes and tasseled loafers for pj's and furry slippers? How do I convince my company to get one—before the Monday meeting?"

Of course, creating an army of telecommuters is not your organization's sole purpose, but if it has more than a handful of off-site workers, it's a candidate for a remote-access server (RAS)—whether you know that or not. RASs provide access to the corporate LAN for telecommuters, work-at-home personnel, and those at smaller satellite offices. RASs typically have multiple ports so several users can dial in at once.

For this roundup, we focused on products that support a minimum of eight concurrent dial-up users, which should support a small to medium-size company or branch office. The five products we review can all support a mix of analog and ISDN lines, giving you flexibility if your needs change. All of our review products include graphical management software, making installation and configuration much easier than the previous generation of RAS products.

USERS CAN DIAL BETWEEN LANs ►

You can connect two LANs by configuring a remote-office RAS to dial up your HQ RAS, so remote clients can access local servers and vice versa.



CLIENTS ON THE LAN CAN USE THE RAS TO DIAL OUT ▲

Users sitting on the network at headquarters can use their RAS to dial out to an ISP through the RAS.



By Les Freed

Before you choose a remote-access solution for your company, you need to make three important decisions. First, you need to choose between RAS and a virtual private network (VPN), which does the same thing as a RAS but connects you to the LAN via a public Internet connection (typically a dial-up ISP account). Second, if you decide to go with a RAS, you need to choose between ISDN and traditional phone lines for your RAS connection. Third, you need to decide how many lines you need to serve your remote users.

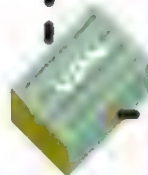
RAS OR VPN?

A RAS connects directly to dial-up analog or ISDN phone lines. Remote users connect to the LAN by dialing into the RAS using a modem and the same dial-up networking software used for Internet access. RAS users outside of your office's local calling area have to make long-distance calls into the RAS.

One big advantage to a VPN is that users can connect to the LAN no matter where they are by making a local call to their ISP's local number. On the downside, VPNs require a fast, full-time Internet connection to the host LAN. For many smaller

...And the VPN Alternative

Virtual private networks can be implemented in two ways: A mobile user can dial into an ISP, connect to the Internet, and then establish a secure tunnel to the HQ network...►



...or the LAN client can get a similar secure tunnel through a local VPN gateway attached to the Internet instead. ►



companies and branch offices, the cost of the Internet bandwidth outweighs the benefit as well as some very big security issues. As a very general rule, RASs are cheaper to operate if the bulk of your users are in the local calling area, and VPNs are cheaper if most of your users are a long-distance or toll call away.

ISDN OR ANALOG?

If you decide to install a RAS, you'll have to choose between ISDN and ordinary analog phone service for your RAS connections. Traditional phone lines are ubiquitous and inexpensive, but they're also slow. The new V.90 modems might seem to be a solution to the speed problem, but V.90 modems can operate at 56 Kbps only if the server end of the connection—the RAS in this case—is connected to a digital T1 or ISDN line and has a digital line. Analog-to-analog connection speeds are limited to 33.6 Kbps.

ISDN lines offer higher speeds than modems but are often more expensive to install and operate than traditional phone lines. On the other hand, a single ISDN line provides two independent 64-Kbps connections, so each ISDN line can handle two incoming calls at once. In some areas of the country, the local phone company charges a per-minute usage charge on ISDN calls, so make the cost comparison before you decide.

Besides cost, you also have to evaluate what users are doing. For e-mail and some file transfers, analog is fine; for heavier use or for running applications, choose ISDN. ISDN makes sense for full-time remote users who need to perform as if they were on the LAN.

All of the products in our roundup can operate with either analog or ISDN lines, but only the 3Com SuperStack II RAS 1500 can handle analog and digital callers on the same line. The other products require separate ISDN and analog lines.

HOW MANY PORTS?

Your final RAS buying decision may be the most important—and the most difficult. Most RAS vendors recommend one dial-up port for every ten remote users. But if you have more telecommuters and satellite-office users than road warriors, we recommend a 1:2 ratio, as telecommuters tend to stay connected to the server longer.

Editors' Choice

• Shiva LanRover 8 E/Plus



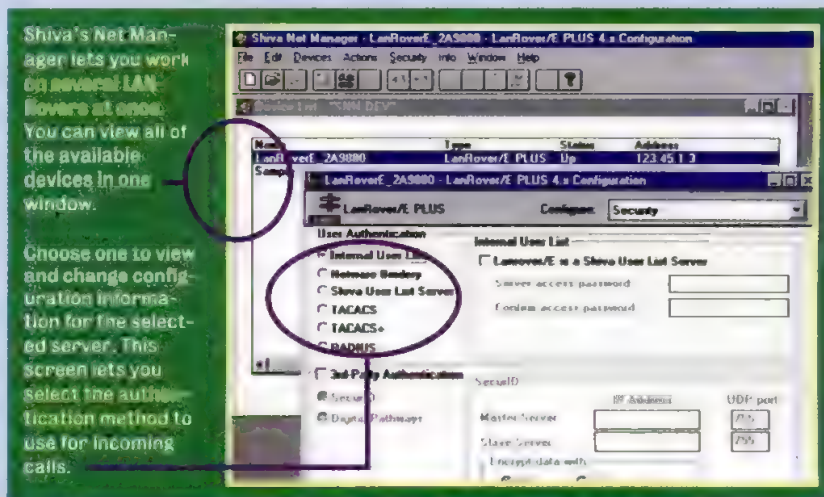
Shiva invented the market for small-business remote-access servers and still outshines its worthwhile competitors. For an unbeatable combination

of price, performance, and features, we award our Editors' Choice to the Shiva LanRover 8 E/Plus.

The Shiva unit performed better than any other RAS in this roundup, on both our standard and heavy-load tests. It costs only \$362 per port for an eight-port analog box, the best value among the RASs we reviewed. And its architecture, easy setup, and management

features make it a complete package.

Deserving of an honorable mention is the 3Com SuperStack II RAS 1500. It offers a very attractive modular expansion capability, and it's the only product in our roundup that can handle ISDN and analog calls on the same ISDN line if you upgrade from analog modems. Once a few glitches in this new product are resolved, it will be a major player in the market.



All of the products in our roundup let LAN users make outbound calls with the RAS's modems. Your users can take advantage of this feature to connect to an ISP for Internet access, or they can use the RAS modems to send outgoing faxes. If you'll be using the out-dial feature, be sure to add an extra line or two to your calculations.

The products we review primarily vary in cost (in particular price per port) and scalability. Read on to choose which product best suits your company's needs.

Ascend MAX 800

With 8 modems, \$3,316 list; with 4 ISDN BRI adapters, \$4,200. Alameda, CA; 800-272-3634, 510-769-6001; www.ascend.com; 530 at www.pcmag.com/infolink.

● Although the Ascend MAX 800 is the company's smallest RAS, it retains the excellent security, management, and flexibility found in Ascend's larger MAX routers. At \$414 per port, it's the second-least-expensive RAS on our tests. Unfortunately, the MAX's performance didn't

Our Contributors: LES FREED and STEVE RIGNEY are contributing editors of *PC Magazine*. BRAD WALDEN is a technical analyst at PC Magazine Labs. RUSS IWANCHUK was the project leader, and DAVID LIDSKY was the associate editor in charge of this story.

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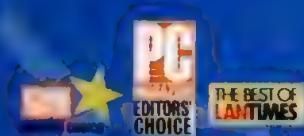
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live up to our expectations. It was the slowest product in this roundup on the Standard Load test—with 16 percent less throughput than the first-place LanRover—and finished in the middle of the pack on the Power-User Load test.

The Ascend box couldn't complete our tests when software compression was enabled. With Ascend's help, we identified a software bug in the RAS's code that causes it to lose a packet when it's handling the Lotus Notes traffic test with compression on. Our performance test suite stopped on those clients creating Notes traffic but did not bring down the session, and you might not notice the problem we encountered in a real-life situation, because the packet would just get resent. Ascend expects to have a fix by the time you read this.

Like the Ascend MAX 200 it replaces, the MAX has eight Type II PC Card slots, which can accept any combination of third-party analog modems or Ascend's own ISDN cards. This excellent flexibility lets you change modems and ISDN cards at will.

We tested the MAX with a variety of PC Card modems from MultiTech, 3Com, and Xircom with no problems. Because the MAX's PC Card slots are stacked in four rows of two, buyers must be careful to choose modems that can operate in this configuration. Many modems won't work, because the cable from one modem gets in the way of the other modem's jack. Unlike the other MAX products, the Ascend MAX 800 doesn't offer a digital modem option, so you'll need to order separate ISDN and analog lines if you need to service both types of callers.

Although Ascend's hardware has always been first-rate, the company's configuration software has often been a step or two behind the competition, in terms of having a GUI or browser-based management interface. Ascend's new NavisConnect puts the company back on a par with the competition, providing an excellent suite of graphical management tools. Installation using NavisConnect took approximately 15 minutes, about the same as the other products in our roundup.

The Ascend MAX 800's PC Card-based design offers great flexibility, but Ascend still has some performance issues to iron out.

Compaq Remote Access Server 5208

\$5,939 list. Houston; 800-345-1518; www.compaq.com.

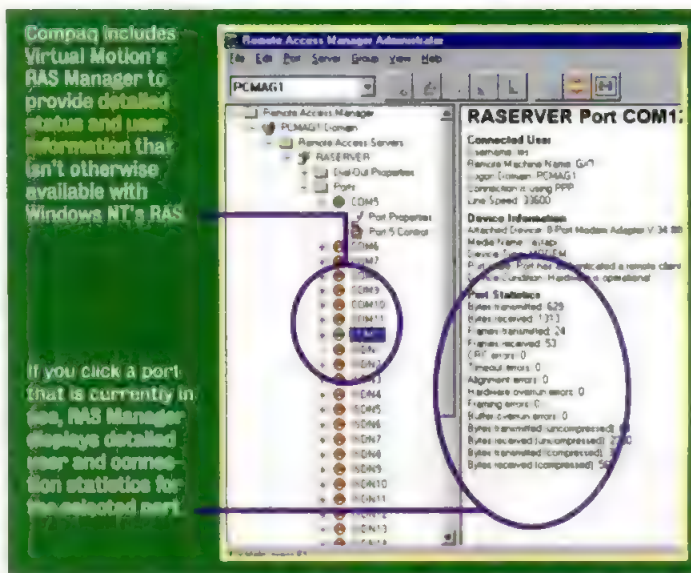
● One of two PC-based products in our roundup, the Compaq Remote Access Server 5208 is the only one based on Microsoft Windows NT's RAS. Other Windows-NT-based RAS solutions often involve two or more vendors. We like the concept of buying a prepackaged, Windows-NT-based RAS from a single vendor, but we don't like Compaq's cost: At

tle digging uncovered the fact that the default serial port speeds were set to 19.2 Kbps. After we adjusted the speeds up to 115.2 Kbps, the 5208 turned in the second-best results in our test group.

Windows NT's built-in RAS provides basic dial-in and dial-out RAS and IP routing services, but its administrative controls are weak compared with standalone servers such as the Ascend or Shiva products. Recognizing this, Compaq bundles Virtual Motion products to add the management and monitoring options that are

missing from the native Microsoft RAS product. This makes the features of the Compaq competitive with standalone RASs.

RAS Monitor provides at-a-glance status monitoring, and Internet LANBridge provides Internet connectivity for IPX-only LAN clients. Windows NT RAS uses Windows NT domain security, so you won't need to maintain two user lists as you will with all of the other



\$742 per port in an eight-user configuration, it is nearly twice the price of the Shiva LanRover 8 E/Plus. Small businesses looking for an all-in-one box may be interested in the 5208, however. With a 233-MHz Pentium II processor, 64MB of RAM, and a 3GB hard disk, the unit can do double duty as a fax, file, print, or application server.

You do get a lot of convenience for your money. The 5208 is the only product in our roundup to provide a 10/100 Ethernet interface (the others were 10-Mbps only), and a Token-Ring interface is available as an option. This gives you the most flexibility to connect Compaq's RAS to a wide variety of devices.

Another plus here is that Compaq preinstalls all of the 5208's hardware and software at the factory, so installation is simply a matter of connecting the cables. Configuration is equally easy; in most cases, all you'll need to do is change the 5208's IP address and network name.

On our initial performance tests, the 5208 turned in disappointing results. A lit-

tle digging uncovered the fact that the default serial port speeds were set to 19.2 Kbps. After we adjusted the speeds up to 115.2 Kbps, the 5208 turned in the second-best results in our test group.

Unless you like having a multiple-use server, you'll probably find that a specialized solution is more elegant and more cost-effective than the Compaq Remote Access Server 5208.

MultiTech MiniArray III Remote Access Server

With 8 analog modems, \$4,599 list. Mounds View, MN; 800-328-9717; www.multitech.com; 531 at www.pcmag.com/infotek.

● A turnkey PC-based RAS like the 5208, the MultiTech MiniArray III Remote Access Server is touted for its flexibility, because you can swap out the proprietary OS. It is also touted for its expandability, because it supports connections for as many as 32 remote users, the best of the five products we reviewed in this roundup. But if you would go to the trouble of pulling out MultiTech's RAS-



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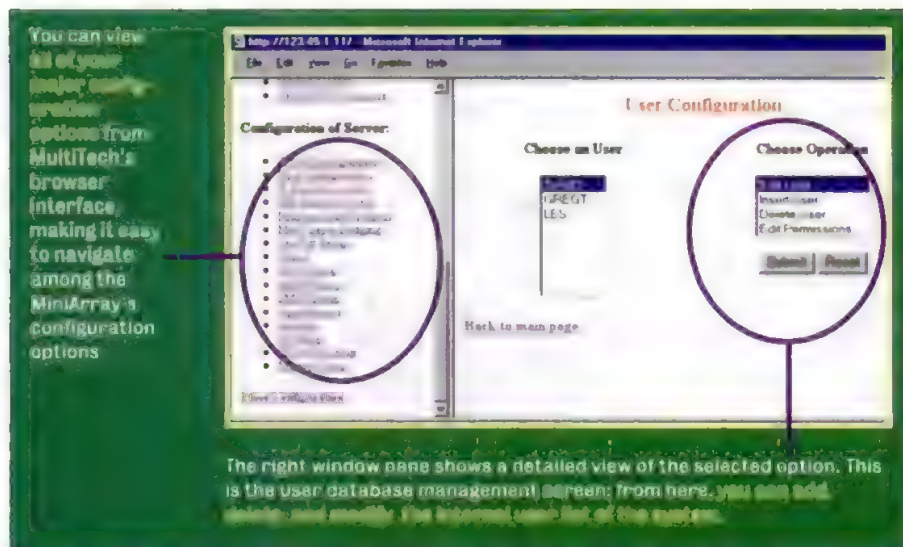
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Express software, you should think about building your own from scratch. And if you need to support as many as 32 users, you might not be looking at the right RAS market segment; try a bigger box.

At \$575 per port, the MiniArray costs slightly more than most of the products in our roundup. And it's the only one that does not support Stac compression, so if you use ISDN, the MiniArray is not an option: The comparable and cheaper

Ascend and Shiva offerings do have Stac compression, and either is a better choice.

When you first power up the MiniArray, the system boots directly into MultiTech's DOS-based RASExpress server software. Before you dread the thought of having to wrestle with DOS every time you need to manage your RAS, only the initial configuration needs to be done directly at the server's keyboard. Subsequent configuration changes can be made from any PC

on the LAN using TCP/IP, telnet, a Web browser, or the included Windows-based graphical manager program.

Despite the server's DOS code base, the MiniArray offers some of the best and most flexible management tools in our test group. We found the browser interface to be the most effective and easiest to use of the configuration tools. During operation, the server's screen displays a quick overview of activity on each of the system's modems. Several status and statistical views are also available from the server's console and from the Web and graphical management screens. All three views let you see who's dialed into each port at a glance, a feature missing from the other products.

During testing, the MiniArray came in third on the Standard Load test but slipped to fourth on our Power-User Load test. This could foreshadow problems scaling the MiniArray to handle more users in a heavy-load environment.

The MultiTech MiniArray III Remote Access Server has some interesting features, but you'll find more value for your money in the Shiva LanRover 8 E/Plus.

Create Your Own RAS Solution

Whether building a deck or choosing a remote-access server, at some point you have to decide if you should do it yourself or have someone else do it for you. Though you can buy a turnkey solution such as the products we review here, you can also take a copy of Microsoft Windows NT Server or Novell's NetWare Connect, a server PC, and a multiport modem card and create your own RAS. Both options have advantages and disadvantages, but unless you have particular expertise in doing it yourself and have the necessary materials on hand, a turnkey solution is still the way to go.

You could create your own RAS solution if you have an available PC server, extra modems, and server software. All you'll need to add is the multiport modem card, which costs about \$2,000 for eight analog ports or \$3,500 for ISDN. This is generally cheaper than a turnkey solution; the least-expensive model in

our roundup is the Shiva unit, at \$2,800 for eight analog modem ports.

All of the multiport modem products are easy to install and include support for the Plug and Play standard. They are also designed to work closely with Windows NT and come with all the drivers you'll need. For establishing inbound and outbound calls, the products rely on Windows NT's RAS product, which comes free with the OS. They also rely on the OS for securing files and restricting access.

Both the Microsoft and Novell products will also work with Novell's NetWare Connect, but Windows NT RAS is obviously the vendor's first choice. You gain ease of use and save time and money in training regardless of your network OS, because you know how it works and don't have to learn a proprietary OS.

Before you jump in, you should take into account some of the potential down-

sides to building your own RAS. You'll face an integration effort by putting the pieces together yourself and making sure that everything works well together. This in turn results in a support issue: Which vendor do you call when you have a problem?

Another problem with relying solely on Windows NT RAS is that you won't find a lot of the features that most of the turnkey products take for granted. For example, Windows NT currently doesn't offer the ability to limit concurrent user sessions, to assign lines for connection, or to set times for when users can connect. You'll also miss any remote management capability.

On the whole, doing it yourself is a decent entry-level approach, but you may find yourself needing some of the additional features that a turnkey remote-access server can offer.

—Steve Rigney

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PERFORMANCE TESTS

Remote-Access Servers



On our tests, each of these products performed sufficiently under standard load conditions. If you need to handle power-user traffic or expand to support more users, scalability and performance will play a larger role in your buying decision.

For a remote-access server to be useful to your company—letting telecommuters, road warriors, and branch-office staffers work as if they were sitting in headquarters—it needs to be able to handle the loads you'll place on it. Both our standard and power-user tests hit all eight RAS ports simultaneously with traffic typical of remote-access sessions: Dial-up clients sent and received files, downloaded Web text and GIF files, and received Lotus Notes e-mail. On our standard test, each client handled only one type of network traffic, but on our power-user test, each client simultaneously handled all the tasks mentioned.

On our power-user test, the MultiTech MiniArray III Remote Access Server fell from third to last place among products that completed the test. This could foreshadow problems scaling the MiniArray to handle more users in a heavy-load environment. We don't report a power-user score for the 3Com SuperStack II RAS 1500, because it repeatedly failed the test, resetting itself a few seconds into our testing. 3Com engineers have identified this as a buffer allocation problem, which should be addressed by the time you read this.

Generally, the Compaq Remote Access Server 5208 and the Shiva LanRover 8 E/Plus were the most reliable at answering a call and not dropping the connection. We experienced unexplained call dropping with the Ascend MAX 800 and the MiniArray. This would be problematic in high-traffic dial-up scenarios, resulting in higher phone costs and frustrated users.

To explore the effect of software compression on throughput, we ran several additional tests with Stac compression enabled (the results are not charted). The particular mix of traffic that we used did not benefit much from compression, but you might find better results in your environment. One exception was the LanRover, which had worse scores with Stac compression enabled (we tested with V.42bis compression on as well, and Shiva blames the over-

head involved in trying to compress already compressed data). And the MAX was unable to perform the Notes e-mail check when compression was enabled (but Ascend promises that the problem will be fixed by the time you read this). A good rule of thumb is to disable software compression when hardware compression is available (over a V.42bis-compliant modem) and to enable it when hardware compression is not (over an ISDN connection).

How We Tested

Our test-bed consisted of eight Dell Dimension XPS Pro200n clients—200-MHz Pentium Pro machines running Windows 95 OSR2, each with 32MB of RAM and using Dial-Up Networking 1.3 over an external 3Com U.S. Robotics 33.6-Kbps modem. They placed calls over our dedicated internal Lucent Definity PBX to the server being tested.

Our **Standard Load** test groups the eight clients into four pairs. Three of the pairs run one type of traffic each—a 100K file send, 100K file receive, or Notes e-mail check—while one pair simulates a Web session by downloading 1K of HTTP text and 10K of GIF data simultaneously. This test best approximates standard dial-up sessions. Our **Power-User Load** test has every dial-up client simultaneously performing these five tasks.

In each case, we run the test for 10 minutes, and we use Ganymede Software's Chariot, Version 2.2, to measure the average throughput per client and per task.—*Analysis written by Russ Iwanchuk and Brad Walden*

PERFORMANCE TESTS

Bold type denotes first place.

PC denotes Editors' Choice.

Standard Load Power-User Load

Throughput (Kbps)

Ascend MAX 800	188	283
Compaq Remote Access Server 5208	216	315
MultiTech MiniArray III	206	264
Shiva LanRover 8 E/Plus	225	319
3Com SuperStack II RAS 1500	199	N/A

N/A -- Not applicable. The product did not complete this test.

BETTER

▲ On both tests, the Shiva LanRover 8 E/Plus scored the highest, despite its modest CPU and minimal memory. It was followed closely by the Compaq Remote Access Server 5208. Looking at

their similar scores, we don't see a meaningful performance advantage in choosing your RAS based on the box's architecture (the LanRover is a proprietary solution, while the 5208 is PC-based).

Shiva LanRover 8 E/Plus

\$2,900 list. Bedford, MA; 800-977-4482; 781-687-1300;
www.shiva.com; 532 at www.pcmag.com/infolink.



Shiva's original LanRover single-handedly defined the small RAS marketplace. The latest version's excellent performance, best per-port cost of any product in this roundup (just \$362), and

excellent management features show that it's still the one to beat.

We tested the analog V.34 version of the Shiva LanRover 8 E/Plus, which includes eight internal analog modems. The LanRover line has always performed well, and this latest version is no exception. The LanRover nosed out the much more expensive 5208 for top performance honors.

Shiva was one of the first RAS vendors

to provide a Windows-based GUI for its RAS products, and its Net Manager is still one of the most complete and easiest to use. Installation and initial configuration take only about 15 minutes. A separate Shiva Monitor program provides real-time status monitoring of the LanRover, but Shiva Monitor does require IPX/SPX and won't work on an all-IP network. The LanRover's front and rear panels include status monitoring LEDs for each port, so

A woman is shown from the chest up, wearing a black dress with white geometric patterns that resemble a stylized 'X' or a network of lines. She has her arms outstretched to the sides. The background is a solid blue color.

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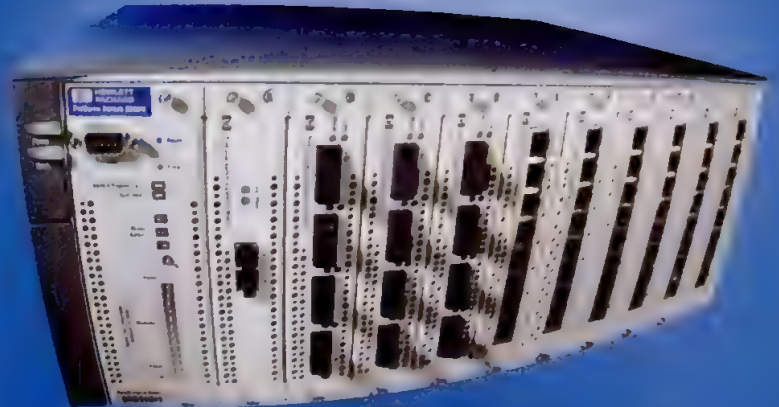
HP ProCurve switches
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inform you of what they did.

The HP ProCurve
2400M is a 24 port
stackable desktop switch
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HP ProCurve 4000M	\$99 per port*
3Com SuperStack II 3300	\$169 per port
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Cisco 2924-XL	\$166 per port

*\$24 per port when \$400 rebate is included

4000M, 8000M, and 2400M prices are based in U.S. list prices effective 11/13/98. HP ProCurve 1600M U.S. list price effective 1/1/99. Savings claims based on U.S. list prices effective 11/13/98 for HP ProCurve 4000M, 3Com SuperStack II 3300, Bay Networks 450T and Cisco 2924-XL switches in 72 port configuration. HP ProCurve 1600M configured with 24 ports. ©Hewlett-Packard Company

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SUMMARY OF FEATURES

Remote-Access Servers

PC MAGAZINE
EDITORS' CHOICE

	Ascend MAX 800	Compaq Remote Access Server 5208	MultiTech MiniArray III Remote Access Server	Shiva LanRover 8 E/Plus	3Com SuperStack II RAS 1500
■ YES ■ NO					
List price of tested configuration	\$4,200	\$5,939	\$4,599	\$2,900	\$3,985
Architecture	Proprietary	Windows NT	DOS	Proprietary	Proprietary
Processor (speed)	AMD 29020 (20 MHz)	Intel Pentium II (233 MHz)	Intel Pentium (100 MHz)	Motorola MC68EC020FG25 (25 Mhz)	Two IBM PowerPC 403GCX (30 MHz)
Installed RAM	8MB	32MB	16MB	2MB	8MB per processor
Management OS support					
Windows 95 / 98 / NT	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Macintosh/Unix	■ ■	■ ■	■ ■	■ ■	■ ■
Maximum number of modems supported	8	16	32	8	8
Supports internal/external modems	■ ■	■ ■	■ ■	■ ■	■ ■
Supports digital modems	■	■	■	■	■
Supports V.90 / ISDN BRI	■ ■	■ ■	■ ■	■ ■	■ ■
Number of ISDN BRI physical lines supported	4	8	8	4	12
Ethernet interface	10Base-T	10/100Base-T	10Base-T	10Base-T	10Base-T
Supports PPP / SLIP	■ ■	■ ■	■ ■	■ ■	■ ■
Supports Multilink PPP / BACP	■ ■	■ ■	■ ■	■ ■	■ ■
Supports PPP/Stac compression	■ ■	■ ■	■ ■	■ ■	■ ■
Reboot required for configuration changes	■	■	■	■	■
LAN Protocol Support over Modem					
TCP/IP / IPX / NetBEUI	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
AppleTalk	■	■	■	■	■
Authentication Support					
PAP / CHAP	■ ■	■ ■	■ ■	■ ■	■ ■
TACACS / TACACS+	■ ■	■ ■	■ ■	■ ■	■ ■
RADIUS	■	■	■	■	■
Internal/Shared internal/Local	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■	■ ■ ■
Bindery/Windows NT domains	■ ■	■ ■	■ ■	■ ■	■ ■
Customer Service					
24-hour, 7-day technical support	■	■	■	■	■
Technical-support number	800-272-3634	800-652-6672	800-972-2439	800-957-4482	408-326-5000
Warranty	90 days	3 years	2 years	1 year	1 year

you can check system usage at a glance.

The Shiva LanRover 8 E/Plus is a small, rack-mountable chassis with a built-in Ethernet interface (the *E* stands for Ethernet; a Token-Ring version is also available) and eight proprietary card slots. The standard LanRover includes eight RS-232 ports, so you can connect your own modems or ISDN adapters.

You cannot expand the LanRover beyond eight ports, unlike the offerings from Compaq, MultiTech, or 3Com. But Shiva has made it easy to run multiple LanRovers on a single LAN. Shiva's Net Manager can manage multiple units from a single administration PC, and any LanRover can share its internal user database with other LanRovers on the same LAN.

Don't let the low price fool you: The Shiva LanRover 8 E/Plus is easy to set up and configure, performs well, and provides excellent value for the money.

3Com SuperStack II RAS 1500

With 8 analog modems, \$3,985 list. Santa Clara, CA; 800-638-3266; www.3com.com; 533 at www.pcmag.com/infolink.

● Marrying 3Com's router expertise with U.S. Robotics' ISDN and V.90 modem technologies, the 3Com SuperStack II RAS 1500 is an innovative, expandable, and flexible RAS. The SuperStack has excellent expansion capacity, and it is the only product in our roundup that can handle ISDN and analog calls on the same ISDN line. As much as we liked 3Com's flexible design, though, the unit is not

quite ready for prime time: 3Com needs to work out a few performance snafus.

During testing, the SuperStack crashed and rebooted when we placed a heavy load on the unit. Working with 3Com, they determined that the likely cause is a buffer allocation problem produced by the consistent pounding of our tests. 3Com expects to fix the bug in its OS code that causes the problem by the time you read this. We also had hardware failures with two separate analog modules and had to swap them out.

Feature-wise, the SuperStack replaces and improves on the older 3Com NET-Server/8 I-modem *Plus* product, an Editors' Choice in our previous small remote-access server review (see "Fast Connections in Small Packages," January 20, 1998). Being able to handle ISDN and analog calls on the same line is a great feature. You can provide V.90 connections to your remote users, and because the module switches calls to ISDN, analog V.34, or V.90, you don't need to maintain different numbers for your users.

The SuperStack is a modular system, so you can start with as few as 4 ports and add more later—up to 24 ports in all—as you need to support more users. There are up to 8 ports in the main unit; you then add the stacking units in increments of 8 ports. If you outgrow the basic SuperStack, you can add up to two expansion units (which cost \$1,599 list apiece), each providing two additional I/O card slots. But neither of these are shipping yet, demonstrating the product's immaturity. The expansion cabinets connect to the main SuperStack unit via 200-Mbps FireWire connectors. Each expansion unit contains two CPUs to provide additional throughput capacity, so adding more ports won't overload the system.

3Com's Windows-based Transcend Remote Access Manager software provides graphical access to the SuperStack's configuration. You can also manage the unit via SNMP, or through a command-line interface that is accessible from the administration port or via telnet. The SuperStack itself can provide user authentication, or an external RADIUS, NetWare, or Windows NT server can do the job.

Once the kinks are worked out, the 3Com SuperStack II RAS 1500 may be the server to beat. **PC**

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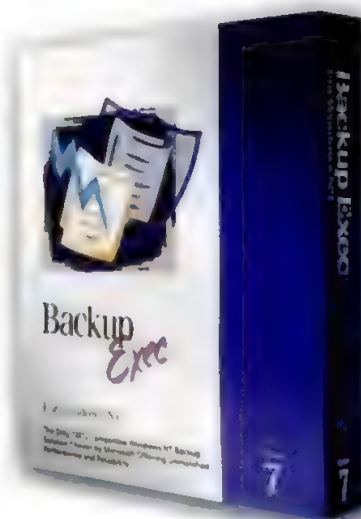
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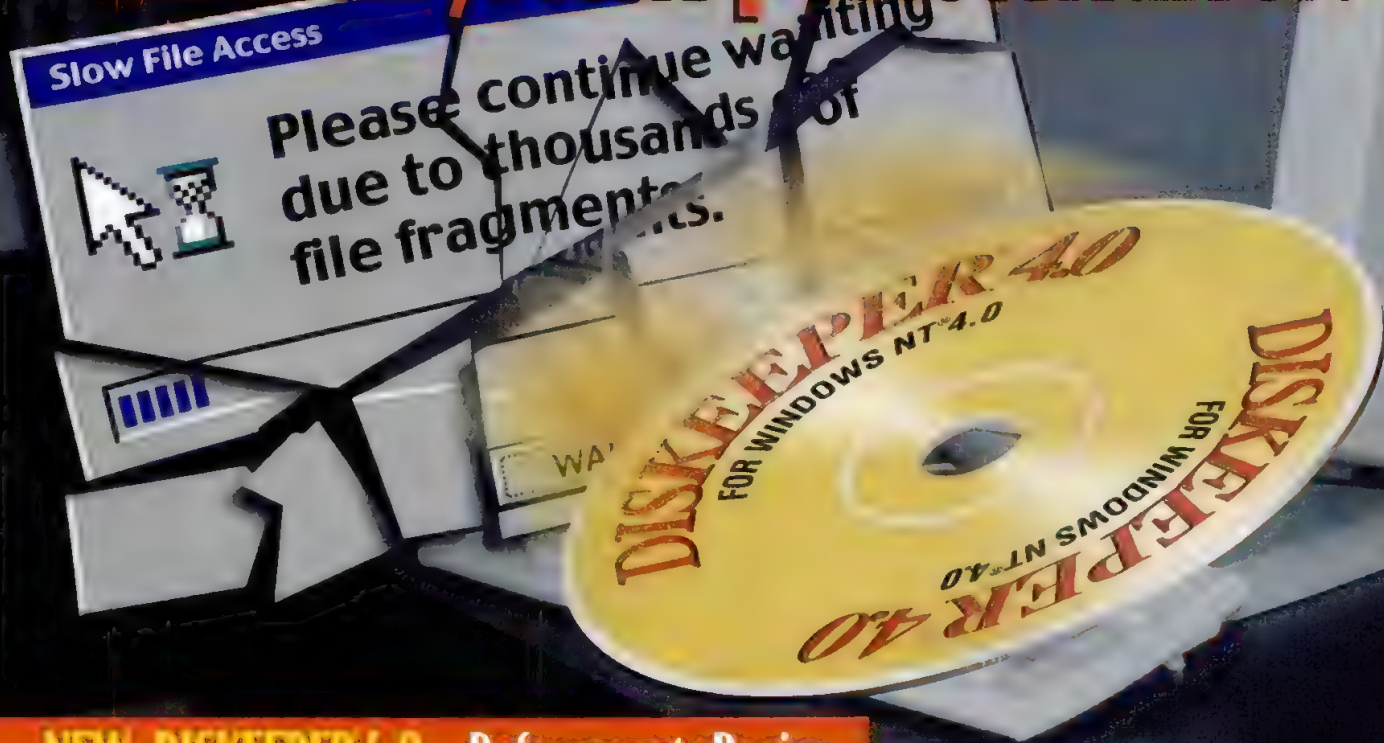
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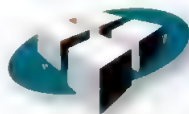
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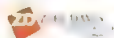
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How Viruses Work



Understanding how viruses work is the first step in defending against them.

By Neil Randall

If you buy a new computer these days, it's likely to ship with an antivirus package. This fact, more than anything else, should convince us of how widespread viruses have become and how much the computer industry has come to accept their inevitability. Quite simply, viruses are a fact of computing life.

There are thousands of viruses out there and many different categories of virus, but generally they all fit a single basic definition. A virus is a computer program intentionally designed to associate itself with another computer program in a way that when the original program is run, the virus program is run as well, and the virus replicates itself by attaching itself to other programs. The virus associates itself with the original program by attaching itself to that program or even by replacing it, and the replication is sometimes in the form of a modified version of the virus program. The infected program can be a macro, and it can be a disk's *boot sector*, the very first program loaded from a bootable disk.

Notice the "intentionally designed" part of the definition. Viruses aren't just accidents. Programmers with significant skills author and develop them, then find ways to get them onto the computers of the unsuspecting. And the stronger antivirus programs get, the harder virus authors work to get around them. For many virus authors, the whole thing is simply a challenge; for others, the point is having a good time making computing life uncertain or even miserable. Too bad: They could make gobs of money solving the Y2K crisis instead.

Viruses have quite correctly gained a reputation for being harmful, but in reality many are not. Yes, some damage files or perform other forms of destructiveness, but many are simply minor annoyances or are even invisible to most users. To be considered a virus, a program need only replicate itself; anything else it does is extra.

Even relatively pain-free viruses aren't completely harmless, of course. They consume disk space, memory, and CPU resources and therefore affect the speed and efficiency of your machine. Furthermore, the antivirus programs that sniff them out and eliminate them also consume memory and CPU resources; many users, in fact, claim they slow the computer down noticeably and are more intrusive than the viruses themselves. In other words, viruses affect your computing life even when they're not actually doing anything.

VIRUSES AND VIRUSLIKE PROGRAMS

The above explanation of viruses is actually more specific than the way we tend to use the term *virus*. Other types of programs exist that fit only part of that definition. What they have in common with viruses is that

USER TO USER



Slow Internet log-ons in Dial-Up Networking; one-key access to the Windows Task Manager; preventing an unwanted Explorer window from appearing on start-up; greeting card formats; creating a magic square with Excel; and more. *Page 215.*

UTILITIES



FileAlbum provides a way to group together related files without having to store them in the same directory on your hard disk. You can also add descriptions of the files to the albums. *Page 226.*

ENTERPRISE COMPUTING



The term *client/server* has been bandied about loosely at times. It's not simply a case of one computer serving files to a remote PC. We take a look at the basics of one-, two-, and three-tier client/server architecture, thin and fat clients, and the concept of middleware. *Page 229.*

PC TECH

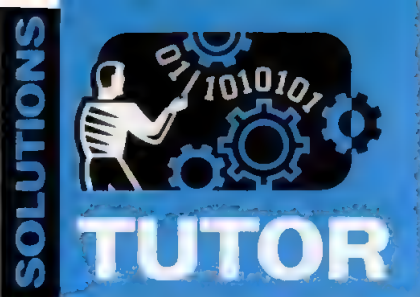


Synchronized Multimedia Integration Language (SMIL) lets you put text, still photos, audio, video, and animation into interactive presentations. And you can use it with ordinary hardware and view the results over an ordinary modem connection. *Page 233.*

More on the Web:

You'll find all of the articles, examples, and code files in this section at PC Tech online.

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they act without the user's knowledge and commit some kind of act inside the computer that they are intentionally designed to do. These types include *worms*, *Trojan horses*, and *droppers*. All of these programs, including viruses, are part of a category of program known as *malware*, or malicious-logic software.

A worm is a program that replicates itself but doesn't infect other programs. It copies itself to and from floppy disks or across network connections, and sometimes it uses the network in order to run. One type of worm—the host worm—uses the network only to copy itself onto other machines, while another type, the network worm, spreads parts of itself across networks and relies on network connections to run its various parts. Worms can also exist on a nonnetworked computer, in which case they can copy to various locations on your hard disks.

The name *Trojan horse* comes from the Greek myth, best recounted in *The Odyssey*, in which the Greek army left a wooden horse as a gift to the Trojans, hiding troops inside the horse as it was taken into Troy. The Greeks jumped out and captured the city, ending the long siege. The idea in computers is the same. A Trojan horse is a program that is hidden inside a seemingly harmless program. When that program is run, the Trojan horse launches in order to perform actions that the user doesn't want. Trojan horses do not replicate themselves.

Droppers are programs designed to avoid antivirus detection, usually by encryption that prevents antivirus software from noticing them. The typical functions of droppers are

transporting and installing viruses. They wait on the system for a specific event, at which point they launch themselves and infect the system with the contained virus.

Related to these programs is the concept of the bomb. Bombs are usually built into malware as a means of activating it. Bombs are programmed to activate when a specific event occurs. Some bombs activate at a specific time, typically using the system clock. A bomb could be programmed to erase all DOC files from your hard disk on New Year's Eve or pop up a message on a famous person's birthday. Others are triggered by other events or conditions: A bomb might wait for the twentieth instance of a program launch, for example, and erase the program's template files. Viewed this way, bombs are just malicious scripts or scheduling programs.

Viruses can be thought of as special instances involving one or more of these malware programs. They can be spread through droppers (although they need not be), and they use the worm idea to replicate themselves. While viruses are not technically Trojan horses, they act like them in two ways: First, they do things the user doesn't want; second, by attaching themselves to an existing program, they effectively turn the original program into a Trojan horse (they hide inside it, launch when it launches, and commit unwanted acts).

HOW A VIRUS WORKS

Viruses work in different ways, but here's the basic process.

First, the virus appears on your system. It usually enters as part of an infected program file (COM, EXE, or boot sector). In the past viruses traveled almost exclusively through the distribution of infected floppy disks. Today, viruses are frequently downloaded from networks (including the Internet) as part of larger downloads, such as part of the setup files for a trial program, a macro for a specific program, or an attachment on a e-mail message.

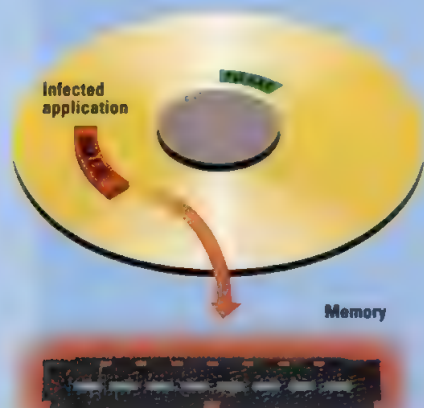
Note that the e-mail message *itself* cannot be a virus. A virus is a *program*, and it must be run to become active. A virus delivered as an e-mail attachment, therefore, does nothing until you run it. You run this kind of virus by launching the attachment, usually by double-clicking on it. One way to help protect yourself from this kind of virus is simply never to open attachments that are executable files (EXE or COM) or data files for programs, such as office suites, that provide macro-writing features. A graphics, sound, or other data file is safe.

A virus starts its life on your PC, therefore, as a Trojan horse-like program. It is hidden within another program or file and launches with that file. In an infected executable file, the virus has essentially modified the original program to point to the virus code and launch that code along with its own code. Typically, it jumps to the virus code, executes that code, and then jumps back to the original code. At this point the virus is active, and your system is infected.

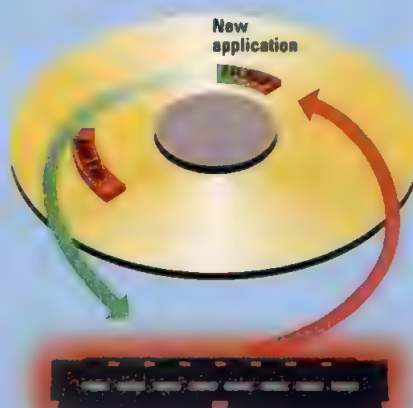
Once active, the virus either does its work immediately—if it's a *direct-action virus*—or

How a Common Virus Spreads

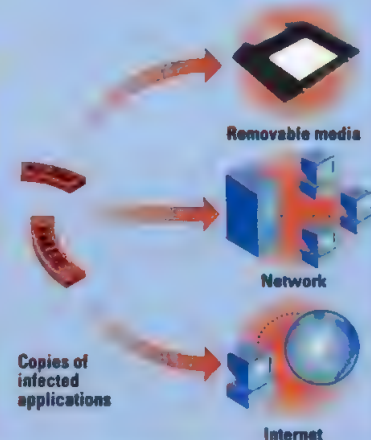
- 1 An application infected with a common virus loads into memory. Even when the application terminates, the virus remains in memory.



- 2 The virus infects one or more other applications. Some viruses use idle time to search for applications, while others infect applications as they are loaded into memory.



- 3 These virus-infected applications can then be transmitted via removable media, a network, or the Internet.



sits in the background as a memory-resident program, using the *TSR (terminate and stay resident)* procedure allowed by the operating system. Most are of this second type and are called *resident viruses*. Given the vast range of activities allowed by TSR programs—everything from launching programs to backing up files and watching for keyboard or mouse activity (and much more)—a resident virus can be programmed to do pretty much anything the operating system can do. Using a bomb, it can wait for events to trigger it, then go to work on your system. One of the things it can do is scan your disk or (more significantly) your networked disks for other running (or executable) programs, then copy itself to those programs to infect them as well.

VIRUS TYPES

Virus authors are constantly experimenting with new ways to infect your system, but the actual types of virus remain few. These are *boot sector viruses*, *file infectors*, and *macro viruses*. There are different names for these types and some subtypes, but the idea remains the same.

Boot sector viruses or infectors reside in specific areas of the PC's hard disk, those that are read and executed by the computer at boot time. True boot sector viruses infect only the DOS boot sector, while a subtype called the *MBR virus* infects the master boot record. Both of these areas of the hard disk are read during the boot process, during which the virus is loaded into memory. Viruses can infect the boot sectors of floppy disks, but typically a virus-free, write-protected boot floppy disk has always been a safe way to start the system. The problem, of course, is guaranteeing that the floppy disk itself is uninfected, and that's a task that antivirus programs attempt to do.

File infectors, also called *parasitic viruses*, are viruses that attach themselves to executable files, and they are the most common and the most discussed. Such a virus typically waits in memory for the user to run another program, using such an event as a trigger to infect that program as well. Thus they replicate simply through active use of the computer. There are different types of file infectors, but the concept is similar in all of them.

Macro viruses, a relatively new type, make use of the fact that many programs ship with programming languages built-in. The languages are designed to help users automate tasks through the creation of small programs called *macros*. The programs in Microsoft Office, for instance, ship with such a built-in language, and in fact it provides many of its own built-in macros. A macro virus is simply a macro for one of these programs, and indeed this type of virus became known through its

Some Common Viruses

Name	Type	What it infects	Characteristics
Aol4free.com	Trojan horse	Nothing (causes harm but does not spread to other programs)	When run, uses Deltree command in DOS to erase hard disk; different from the Aol4free virus hoax, which predates it
Form	Resident boot sector	Floppy disk boot sector	Fairly old but very common; causes clicking sound when key is pressed
Hare	Resident polymorphic multipartite	COM and EXE files, master boot record, floppy disk boot sectors	Activates on August 22 and September 22, attempts to erase A:, B:, and C: drives
Java.App Strange Brew	Direct-action file infector	Java-class files	First virus to infect Java apps; because it affects Java, it can spread across operating systems. No known damage.
Microsoft.Excel.Spellcheck	Macro	Excel spreadsheets	Creates file Spellck.xls in Excel start-up directory; harmless by itself but displays messages warning of macro viruses.
Monica (Hanko.4167)	Resident stealth file infector	COM, EXE files	Halts the computer at 7:07 on July 7 (7/7/7:07) and displays "Monica" message.
W95.CIH	Resident file infector	Windows 95 EXE files	Triggered on the 26th of the month; attempts to overwrite the flash BIOS and to corrupt hard disk data.
W95.Marburg	Direct-action file infector	Windows 95/98/NT application files (several types)	Three months after first infection, when an infected application is launched, covers screen with Windows error icons; also erases antivirus software.
W97/X97M Shiver	Macro	Word 97 and Excel 97 documents	First macro virus to infect both Excel and Word files; prevents loading of infected documents
Win32/Semisoft	Resident file infector	Windows EXE files	Sends information from several files on the hard disk to specific IP addresses
WM.PolyPoster	Macro	Word documents	Posts message to certain newsgroups using Free Agent news reader; message includes Word document as attachment
XM.Compat	Polymorphic macro	Excel spreadsheets	Triggered after August 31, 1998, when user closes infected spreadsheet; randomly selects numeric cell and changes its value by 5 percent.

infection of Microsoft Word. When a document or template containing the virus macro is opened in the target application, the virus runs and does its damage. In addition, it is programmed to copy itself into other documents, so that continual use of the program results in continual spread of the virus.

A fourth type, called *multipartite*, combines boot sector infection with file infection.

For a huge listing of viruses along with explanations of what they do, see the Virus Encyclopedia section of Symantec's AntiVirus Research Center, at www.symantec.com/avcenter/vinfodb.html.

SMARTER AND SMARTER

The macro virus concept works because the programming language provides access to memory and hard disks. So, in fact, do other recent technologies, including ActiveX controls and Java applets. True, these are designed to protect the hard disk from the virus program (Java better than ActiveX), but the fact is that these programs can install themselves on your computer simply because you visit a Web site. Obviously, as we become increasingly networked and as we expect such conve-

niences as operating-system upgrades over the Internet (Windows 98 and NT 5 both do this), we put ourselves at greater risk from viruses and other malware.

Virus authors are nothing if not innovative, and they constantly come up with new ways of thwarting antivirus software. *Stealth viruses*, for example, mislead the antivirus software into thinking that nothing is wrong. Essentially, a stealth virus retains information about the files it has infected, then waits in memory and intercepts antivirus programs that are looking for altered files. It gives the antivirus programs the old information rather than the new. *Polymorphic viruses* alter themselves when they replicate, so that antivirus software that looks for specific patterns won't find all instances of the viruses; those that survive can continue replicating. Several other types of smart viruses are appearing regularly, as the game of cat and mouse between virus authors and antivirus software producers continues. In all likelihood, viruses are here to stay. 

Neil Randall is the author of *The Soul of the Internet (ITCP)* and *Special Edition Using Microsoft FrontPage 98 (Que)*.

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USER TO USER

When Logging On to The Internet Is Slow

I'm using Windows 95's Dial-Up Networking to connect to the Internet. It works fine, but the log-on process seems painfully slow. Could there be something wrong? I recently installed the Verison 1.2 upgrade.

Bob Smith
Lombard, Illinois

PC Performance problems during the log-on process are often the result of incorrect settings in the Dial-Up Networking properties for your connection. For example, if you have the *Log on to network* property enabled when it shouldn't be, that can slow down your Internet log-on quite a bit.

To check the properties for your connection, take the following steps: Double-click on the My Computer icon on your desktop, then double-click on the Dial-Up Networking folder. You'll see a Make New Connection icon and then one icon for each of your existing connections. Right-click on your Internet connection and choose *Properties*. Next, select the *Server Types* tab. At this point your display should look like Figure 1.

If the *Log on to network* box is checked, uncheck it. This setting tells Dial-Up Networking to log on automatically to the remote server using the user name and password you entered when you started up Windows 95.

This option seems to make the most sense when you want to treat a remote network as an extension of your local network and you also wish to use the same user name and password to log on to both machines. If your

Internet user name and password are not the same as the ones you enter when you start up Windows, however, the Log on to Network feature causes a significant unnecessary delay.

Before continuing, review the *Allowed Network Protocols* section and make sure that only the *TCP/IP* box is checked. Then choose *OK* to save your settings. If additional protocols have been checked, that could also slow down your Internet connection.

—Sal Ricciardi

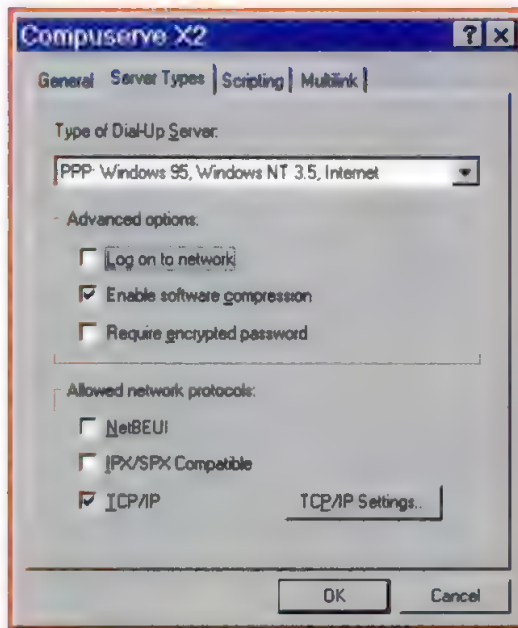


FIGURE 1: If it's taking too long to log on to your ISP, try unchecking the *Log on to Network* option in your *Dial-Up Networking* connection properties. Also, make sure only *TCP/IP* is checked under *Allowed Network Protocols*.

Replacing an Integrated Graphics Adapter

My computer has an integrated graphics adapter that I want to replace with an accelerator card. When I inserted the board and reboot-

ed, however, my monitor screen stayed black. According to the graphics card manufacturer, I must disable the existing graphics circuitry on the motherboard, but I don't know how to disable it. Can you help?

Shane Hatcher
via the Internet

PC Given the pressures to drive complete system costs lower and lower, we can expect to see more and more systems with higher levels of component integration right on the motherboard. This used to be limited to floppy disk and IDE drives and serial, parallel, and mouse ports but now is expanding to include USB, SCSI interfaces, graphics circuitry, modems, and sound card features. In some cases, many of these functions are being provided by a single chip.

Another fact is that many of these highly integrated solutions provide less than optimum performance for one or more of the component functions. As a result, many users will find themselves in the same position, looking to upgrade one or more of the specific functions that are already provided on the motherboard. In most cases, there will be ways to disable a specific function—some motherboards are even auto-sensing and will shut down the conflicting portion when the expansion card is added—but there may also be instances where you cannot get rid of it.

The place to start is the system documentation. If you cannot find the answer there, then contact the system manufacturer for information. If you cannot reach the manufacturer (or if it doesn't know the answer, which might be possible for some of the low-end integrators), check the advanced CMOS configuration settings; you may be able to find a choice that will disable the conflicting function.

If you can't resolve the conflict, you are probably limited to two choices: either live with the integrated feature, or replace the motherboard with one that does not include that particular function (or permits easily disabling it).—Alfred Poor

One-Key Access to Task Manager

On a ZDNet message board, someone recently asked the following: "Is there a way to change Ctrl-Alt-Del to just one key stroke, so that when I need to close a running program, all I have to do is hit one key?" Here's my solution:

Make a new shortcut on the desktop for the program `c:\windows\taskman.exe`. Then right-click the shortcut icon and select *Properties*. Click the *Shortcut* tab, and click inside the *Shortcut key*

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box. Hit the key you want to use (I used F12), then click **OK**. You can now hit the F12 key in any window to bring up a list of the current running programs. Select one and click on the **Windows** menu, select **End Task** and the program will be terminated.

Rodney Beede
Snyder, Oklahoma

PC Taskman.exe's main window (see Figure 2) doesn't look much like the *Close Program* window that appears when you press Ctrl-Alt-Del, but it works just as well to ter-

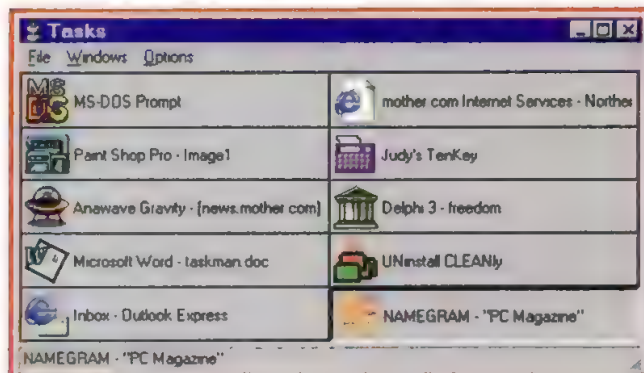


FIGURE 2: The Task Manager will let you terminate a program just as well as the *Close Program* window you get by pressing Ctrl-Alt-Del.

minate a program. Simply select the program's button and choose **End Task** from the **Windows** menu. Make sure *Minimize on use* in the **Options** menu is not checked—otherwise as soon as you click one of the program buttons the Task Manager will disappear. Task Manager can also be used to tile or cascade the main windows of all active programs, or to shut down Windows.

Terminating a program using Task Manager or Ctrl-Alt-Del should always be a last resort. Don't use it just because you'd rather not wait for a long process to finish! And whenever you do terminate a program in this way, your very next action should be to save all your work, close all open programs, and restart Windows.—Neil J. Rubenking

Unwanted Explorer Windows at Start-Up

PC Here's a curious problem that has puzzled many users: Normally, if any Explorer windows are open at shutdown, those windows will be reopened automatically at start-up. Sometimes, however, you'll get an Explorer window every time you start, even when it's very clear that no such window was open at shutdown.

The solution comes from the Microsoft Knowledge Base online ([//support.microsoft.com/support/kb/articles/q145/7/64.asp](http://support.microsoft.com/support/kb/articles/q145/7/64.asp)), and

it's anything but obvious. Two or more spaces between commands on the `load=` or `run=` lines in the `[Windows]` section of `Win.ini` will cause an unwanted Explorer window to appear at start-up. The same is true if either of those lines ends with a comma. If you've been

plagued with an unwanted Explorer window at start-up, you can probably fix it by editing `Win.ini`. Just load the file into Notepad, locate the `[Windows]` section, and look for the `load=` and `run=` lines. Make sure the commands on each line are separated by a single space only, and delete the final comma, if present. Save the file, exit Notepad, and restart Windows.

Now that pesky Explorer window is gone!

—Neil J. Rubenking

Greeting Card Formats

Corel WordPerfect for Windows 7 can subdivide a page into sections, a feature I have not been able to duplicate in Microsoft Word. The feature is useful for creating greeting cards, invitations, and the like. To create a card, you split the page into four sections. Then you put a graphic into the upper-left section and text in the two lower sections. When you print, you fold the printout twice—once from top to bottom and once left to right. The graphic in the upper-left corner will be on the outside front, and the text in the lower half will be on the left and right sides of the inside.

In WordPerfect 7, dividing the page is easy. Choose **Format | Page | Subdivide Page** and you'll get a dialog box asking how many rows and columns to use. Enter 2 for each, and choose **OK**. You can then enter the text or graphic for each section, print it, and fold the output. Word 97 doesn't seem to have an equivalent feature, and there is no reference in the help system for splitting or subdividing a page. Is there any way to do this in Word?

Susan Weller
via the Internet

PC Although Word doesn't have a built-in feature for dividing the page into equal sections, you can use a table to get the same

effect. And once you've created the format, you can store it as a template, so you can reuse it whenever you need it.

Start with a blank document. Choose **File | Page Setup**, then **Margins**, and set the margins however you want them—making sure that the left and right margins match and that the bottom margin is at least 0.2 inches smaller than the top margin, so that the table doesn't spill onto the next page. Choose **OK** to close the **Page Setup** dialog box.

Next choose **Table | Insert Table**, set both rows and columns to 2, set **Column Width** to **Auto**, and choose **OK**. With the **Auto** setting, Word will automatically create two columns of equal width, dividing the page in half vertically. Dividing the page equally in the horizontal direction takes just a bit of arithmetic.

Assuming you have 1-inch top and bottom margins, body text will be 9 inches deep. For you to divide the page in half, the dividing line between columns—and the height of each row—should be 9 divided by 2, or 4.5 inches. To set the row height, select the entire table and choose **Table | Cell Height and Width**, then **Row**. For **Height of Rows 1-2**, choose **Exactly**, and in the **At box** enter 4.5". Make sure you include the " to tell Word to set the height in inches instead of points.

Choose **OK** and Word will resize the rows. It may also move the second row to the next page if you didn't make the bottom margin small enough. If necessary, use the **File | Page Setup** command to adjust the bottom margin to a still smaller size. (If you hate math and prefer using the mouse, note that there's an alternative approach: You can resize the rows—in **Page Layout** view only—by dragging the bottom line of the table to the bottom of the text area on the page, then selecting the table, and choosing **Table | Distribute rows evenly**. However, you may have to experiment with that approach a bit to make it work properly.)

At this point, you'll want to check that you set up the table correctly. If it's not already showing borders to define each cell, select the table, choose **Format | Borders and Shading**, and choose **Borders**, then **All**, and then **OK**. Print the file, and fold the page along the borders.

After you've confirmed that the divisions between the cells fall at the right positions, you can remove the borders. If Word is set to hide gridlines, choose **Table | Show Gridlines** so you can still see the four sections.

Next save the file as a template. Choose **File | Save As**, and set **Save As Type** to **Document Template (*.dot)**; Word should automatically take you to your **Templates** directory. Enter an appropriate name, such as **Greeting Card.dot**, and choose **Save**. Then close the file.

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To use the template, choose **File | New**, select *Greeting Card.dot* as the template to use, and choose **OK**. If necessary, choose **Table | Show Gridlines** so you can see the four sections. You can then either insert text and objects directly into the table cells, or insert them to float over text and use the cells only as guidelines to show you where to move the floating objects. Details



FIGURE 3: Divide a page into quarters in Word 97 using a table, and insert text and a flipped image; now you're ready to fold your document into a greeting card.

will vary, depending on what you're inserting and how you're inserting it. But in general, you can turn the *Float Over Text* option on or off by selecting the object, choosing **Format | Object** and then *Position*, and either checking or unchecking the *Float Over Text* check box. When you've set an object to float over text, you'll also need to choose **Format | Object**, then choose *Wrapping*, and set *Wrapping Style* to *None* to keep the object from pushing the table to the next page.

Note too that you'll have to rotate any text or graphic that's in the top-left corner by 180 degrees, so it will be right side up when you fold the paper. There are varying ways to do this, depending on how you insert the text and graphics. Look for a discussion of how to manipulate graphics this way in a later article. —M. David Stone

Magic Squares

I have heard that it's possible to use Excel to create magic squares. Is this true? How do you do it?

Russell Craig
Burbank, California



PC A magic square is a square-shaped grid containing all the integers from 1 to n^2 (where n is the number of cells on each side of the square), arranged in such a way that all the row totals, column totals, and corner-to-corner diagonal totals are equal. Here's a simple 3-by-3 magic square:

8	1	6
3	5	7
4	9	2

In this example, no matter which way you add up the numbers—vertically, horizontally, or diagonally—you get 15.

You can use Excel or any other spreadsheet to create any magic square with an odd number of cells per side. The method, which I found in the book *Fractals, Googols, and Other Mathematical Tales*, by Theoni Pappas (Wide World Publishing, 1993), is as follows:

1. Enter a 1 in the middle cell of the square's top row.
2. Move up one row and to the right one column, and enter a 2.
3. Move up one row and to the right one column, and enter a 3.
4. Continue in this manner until you've filled the square.
5. Whenever moving up one row takes you outside the square, move instead to the bottom row of the square and one column to the right.
6. Whenever moving one column to the right takes you outside the square, move instead to the first column of the square and up one row.
7. Whenever the foregoing steps lead you to a cell that is already occupied or whenever they lead you outside the square in both directions (particularly when you've filled in the top-right square), move instead to the cell immediately below the cell you just populated (that is, move down one row but stay in the same column).

To see how this works, let's create a 5-by-5 magic square in cells B2:F6. Begin by putting a 1 in the middle cell of the top row, which is D2. Next move up and to the right, to E1. Since row 1 is outside the square, move instead to the bottom—to E6. Put a 2 in E6.

Put 3 in F5. The next number, 4, would go in G4; but column G is outside the square, so it goes in B4 instead. 5 goes in C3.

Moving up and to the right from C3 leads to D2, but D2 is already occupied. So instead go

straight down from C3 to C4, and put 6 there. 7 goes in D3, and 8 goes in E2.

Continuing in this manner, put 9 in F6, 10 in B5, 11 in B6, 12 in C5, 13 in D4, 14 in E3, 15 in F2, 16 in F3 (because B6 is occupied), 17 in B2, 18 in C6, 19 in D5, 20 in E4, 21 in E5, 22 in F4, 23 in B3, 24 in C2, and 25 in D6. Do the sums and you get 65 everywhere. Don't ask me why it works!

I've written VBA code that automates the process in Excel, allowing you to create odd-sided magic squares from 3-by-3 to 253-by-253. You can download this code from our Web site at www.pcmag.com/downloads. You'll find it in the PC Tech archive for this issue. Just select a square-shaped grid (with an odd number of cells per side) and execute the macro. After populating the square, the macro draws a thick border around it, then puts in the column, row, and diagonal sums. To make room for the sums, you'll need a blank row below the selection, a blank row above the selection (to accommodate the lower-left-to-upper-right diagonal sum), and a blank column to the right of the selection.

Before doing anything else, the macro performs a series of validity checks to make sure that you've selected a worksheet range (as opposed to a chart or an OLE object), that the selection is square, that the square has an odd number of cells on each side, that you've selected more than a single cell, and that you've left room for the row and column of totals that the macro intends to create below and to the right of the finished magic square. The macro also checks to see whether your selection is blank. If it's not blank, a message box asks whether you want to continue.

When all that has been accomplished, the macro simply zips through the square-building procedure described above, draws a thick border around the selection, and calculates the row and column totals to prove that you've actually got a magic square.

To speed up execution, the macro also sets *Application.ScreenUpdating* to *False* and turns off the status bar display. Without the latter step, Excel would continuously calculate and display (on the status bar) the total of the cells in the square. With a large square, this effort would slow the macro down dramatically. To accommodate the user who always wants the status bar hidden, the macro checks the status bar status first, then restores the prior status after the square is built—rather than simply turning the status bar back on.

To make the macro easier to run, you might want to assign a keyboard shortcut to it, such as Ctrl-M. Then you can simply select a block of cells, press the shortcut, and amaze your friends and enemies!—Craig Stinson **PC**

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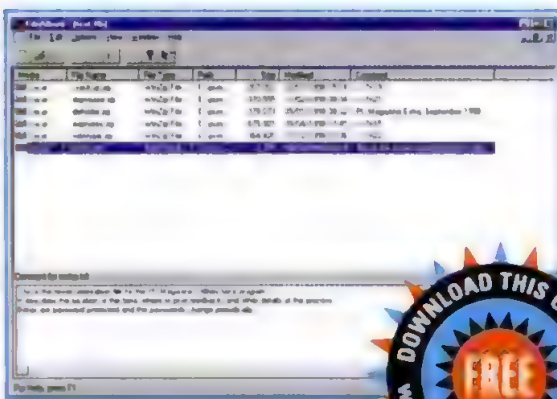
Organize Your Files into Albums

Sometimes it's inconvenient to store all the files that relate to a project in the same directory. This is especially true with files shared across multiple projects. FileAlbum provides a way to group together related files without physically moving them on your hard disk. You can double-click a file to launch its associated application, just as you can in Explorer. A comment field lets you add extended descriptions of the file to the album.

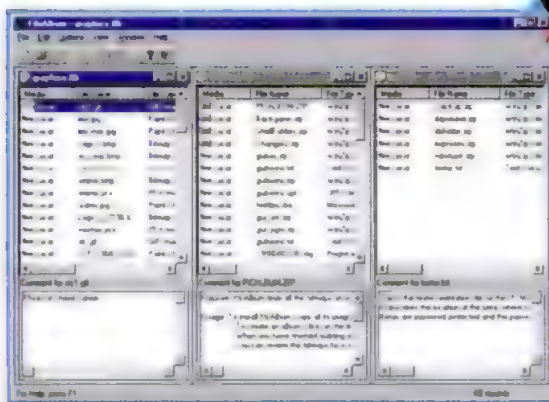
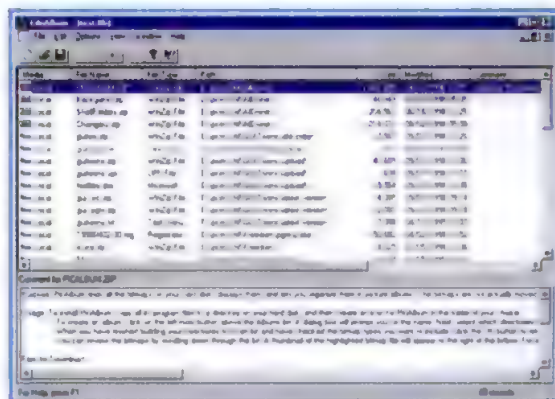
An article about how to use FileAlbum and how it was written is available on our Web site at www.pcmag.com/pctech/index-ut.html. A link to download the utility and its source code can also be found here.

Gregory A. Wolking, author of FileAlbum, is the primary sysop in PC Magazine's Utilities discussion area on the Web and a frequent contributor to PC Magazine. Sheryl Canier is editor of the Utilities column and a contributing editor of PC Magazine.

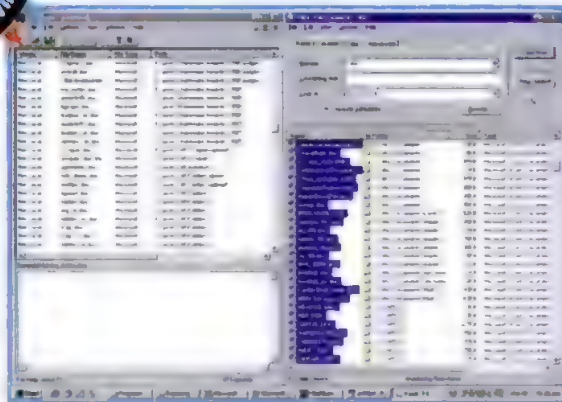
FileAlbum displays an album as a dual-paned window. The upper pane contains a list of the files in the album, and the lower pane displays the comment associated with the selected file.



You can add files to albums by drag-and-drop from Explorer. Any type of file can be added, whether local or on a network.



FileAlbum lets you open multiple albums and tile or cascade them. You can move and copy files between albums using drag-and-drop.



One convenient use of FileAlbum is to save the results of a search from Explorer's Find utility. After performing the search, press Ctrl-A to select the result set, then drag the files to an album.

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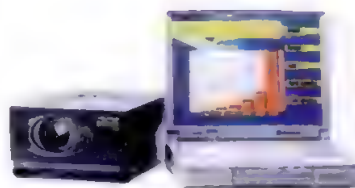
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ENTERPRISE COMPUTING

Understanding Client/Server Computing

By Will Fastie

Back in the eighties when network equipment vendors first started to hawk their wares, the term *client/server* was used to conjure up a host of fancy capabilities offered by the new hardware. Today, *client/server* has a very specific meaning that has nothing to do with hardware at all. Even so, most folks still associate the term *client* with the physical computers they are using and the term *server* with some other physical computer to which they are connected. There's a glimmer of truth there, to be sure, but today *client/server* means much more.

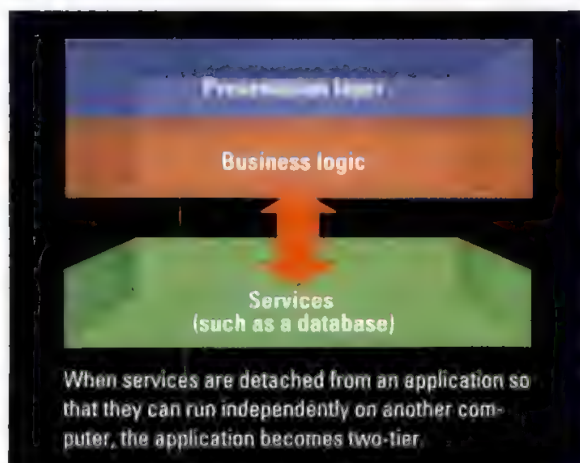
We're going to cover the essentials of client/server computing. We'll define one-tier, two-tier, three-tier, and *n*-tier client/server program architectures; we'll explain the difference between a thin client and a fat client; and we'll discuss the middleware concept. But first, you need to understand a few things about general software architecture.

Most application programs have three major layers. On top is the *presentation layer*, which provides the human/machine interaction (the user interface). The presentation layer handles input from the keyboard, mouse, or other device and output in the form of screen displays. In the middle is the *application or business logic*, the functionality that gives the application program its character. Application logic makes the difference between an order entry system and an inventory control system, for example; it is often called *business logic* because it contains the business rules that drive a given enterprise. The bottom layer provides the generalized services needed by the other layers, including such things as file services, print services, communications services, and, perhaps most important, database services.

For simplicity, we will confine this discussion just to those programs needing data-

base services. That's what most architects first think of when they hear the term *client/server*, but the general rules apply to any kind of service.

The number of *tiers* in a client/server application is determined by how tightly or loosely the three program layers are integrated. A one-tier application is one in which the three program layers are tightly connected. In par-



ticular, the presentation layer has intimate and detailed knowledge of the database structure. The application layer is often interwoven with both the presentation layer and the services layer. All three layers, including the database engine, almost always run on the same computer.

One-tier applications are easy to design

and write, especially with today's modern software tools. It's also possible to create a multiuser one-tier application by running the application on several PCs and having them share the database. The database can be stored either on one of the PCs (a *peer* solution) or on a file server. Note that each PC running the application has its own copy of the database engine; only the data is shared, not the database logic itself.

Multiuser one-tier applications are okay until the number of users gets large. The problem is that all the database work is performed in each client. For example, if the program needs to list all clients with the last name of Smith, all the information (indexes and data records) needed to resolve that query to the database must be transferred over the network. For some complex queries, a significant amount of data must be examined, perhaps even the entire database. At a

more technical level, it is difficult to manage independent database engines to be sure that no conflict arises when two clients attempt to access or update the same record. This is called the *record-locking problem*.

The solution for the performance and technical problems associated with multiuser one-tier programs is two-tier client/server architecture. This type of application is written in mostly the same way as a one-tier application, with the exception that the database service (engine) no longer runs with the client. Instead, it runs on the server computer that contains the database itself. Some method is used to communicate between the application logic layer and the database service.

Today, the method that's most commonly used is the structured query language (SQL), a language that can encapsulate complex database queries in relatively compact sentences. The SQL statement is sent to the database server, which performs the work locally on that physical computer and returns only the relevant information (the answer) to the client PC. Only the database services are separated from the application in

a two-tier design. The presentation and business logic layers remain very intertwined, and both continue to have intimate knowledge of the database.

Two-tier applications are a bit more complex to write, but most development tools are equipped with a great deal of support in their integrated development environments to fa-



ENTERPRISE COMPUTING

cilitate rapid programming. The tools are so good that two-tier programs can be developed almost as quickly as one-tier apps. The only downside is cost. Most tools provide database engines that can handle one-tier designs (such as the Jet engine, used with Access and Visual Basic), but two-tier applications require separate database products such as Oracle, IBM DB2, Sybase, or Microsoft SQL Server.

app server and the database server are irrelevant to the user.

In a three-tier client/server application, the presentation layer usually does not have

intimate knowledge of the database. Instead, the presentation layer communicates with its application server using a predefined message strategy.

The best way to understand this is to think about the Web. Your browser knows absolutely nothing about the structure of the database at Amazon.com, for example, but you are nevertheless able to interact with that database when you order a book. This is the result of well-defined Internet protocols that allow the client (the browser) to talk to an application server (a Web site). You can also order that book from any PC,

not just your own, and using any forms-capable browser.

Three-tier applications are much more difficult to build than two-tier apps. The biggest obstacle is that the software tools' in-

Development tools are so good that two-tier programs can be developed almost as quickly as one-tier apps. The only downside is cost.

tegrated development environments are not aware of the three-tier model the way they are about the two-tier model. As a result, much more hand-coding is required to write a three-tier application. Three-tier apps are also harder to design, because they are somewhat abstract compared with their more direct two-tier counterparts. Software tool vendors are starting to release new versions that tout three-tier or *n*-tier develop-

ment support, but it's not mature development technology just yet.

One point of interest is that a two-tier relationship exists between an app server and its database server. In other words, even though the client in a three-tier application doesn't have intimate database knowledge, the app server does.

The term "*n*-tier" is quite in vogue right now. In truth, three tiers are the maximum; "*n*-tier" refers to the fact that an application server can request services from many other services, and that the services themselves can ask for services as needed to respond properly to the client's original request. The message flows can get pretty complex.

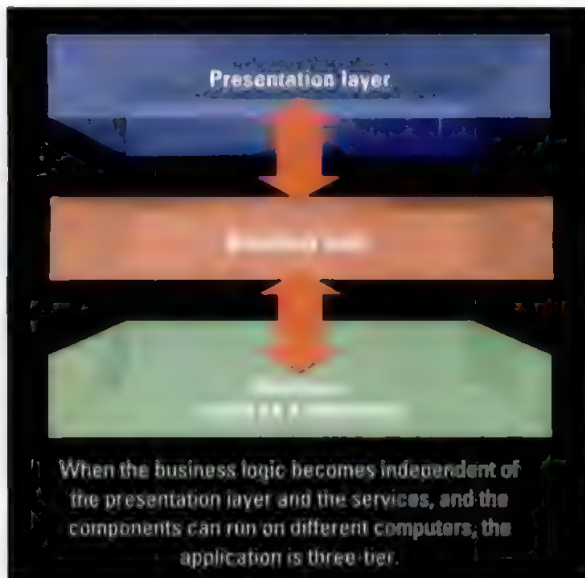
Middleware is the term often used to describe the application or business logic present in an app server. Unfortunately, the same term is also used to describe generic services. For example, to communicate, the three tiers may use a messaging system. This is true middleware in the sense that it functions between, or in the middle of, the three tiers. When someone uses the term *middleware*, be sure you know what specific meaning is intended.

When designing and building a three-tier client/server application, most developers make conscious decisions about how much of the business logic to move into the independent app server. A good example of this is *input-data validation*. Most users like immediate feedback when a datum is invalid. If the app server lives on a different physical computer, there can be a delay before the presentation layer in the client reports that an entry is invalid. To keep good performance, validation rules often live with the presentation layer in the client.

If little or no business logic remains in the client, meaning that it is exclusively a presentation layer, then the client is called *thin*. If the client has lots of business logic, then it is *fat*. The best example of a thin client is your Web browser. It is so thin that it can connect to entirely different applications of which it has no knowledge and still provide a suitable user interface. The whole concept of the network computer hinges on building the cheapest, smallest device that will run a Web browser.

Client/server computing is really much more than a simple separation of a user's PC from a server computer. Hopefully the definitions provided here can give you a leg up the next time you're caught in a jargon-laden meeting. **PC**

Will Fastie is a frequent contributor to PC Magazine.



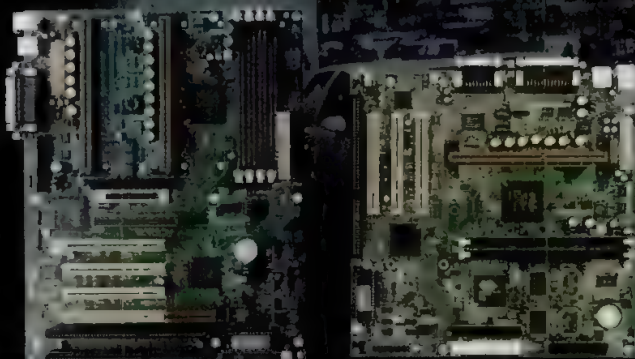
Three-tier client/server applications, as you may have guessed, break all three program layers into independent sections. We have already seen how the database service can run on a different computer. In three-tier designs, the business logic itself becomes a service, and that service can also be run on its own computer. When the business logic becomes a service, it is usually called an *application server* or simply *app server*.

Quite often, the app server runs on the same physical server hardware as the database. Colocation can sometimes benefit performance, so it is usually a first choice. But a key advantage of having an app server is that it can be located in the best place to serve the need.

If you run a business with sales regions, for example, some regions might have many salespeople sharing an app server that's running on a separate physical computer. However, the one salesperson in a remote region might run both the client and the app server on a single PC. No matter how the client and app server are configured, all app servers might receive database services from a centralized computer, perhaps a mainframe. And no matter how the app server is deployed, all users operate the application in exactly the same way from the client. The locations of the

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SMIL: The New Web Format For Multimedia

By William Robert Stanek

As I write this, I'm listening to KJR-FM 95.7. But I'm not listening to it on my stereo. I'm listening to it on my computer. A click of the mouse takes me to a screen preview of *I Still Know What You Did Last Summer*. The live video feed gives me the chills, so I click on over to CNN and cue a video from the archives (Figure 1). Suddenly I realize that I'm watching a video recorded weeks ago, and I'm doing it without a TV or VCR. The presentation is kind of cool. It combines still images, a streaming video feed, and a menu of hypertext links. But what's really cool is that I'm accessing this with a 28.8 modem.

How is this possible? The answer is SMIL (Synchronized Multimedia Integration Language, pronounced *smile*). With SMIL, you can combine text, still images, audio, video, and animations to create interactive multimedia presentations of broadcast quality. But unlike television productions, you don't need multi-million-dollar studios to create SMIL presentations, and you don't need to buy time on cable networks to broadcast your productions to the world either. In fact, all you need to create, publish, and broadcast SMIL presentations is a PC, a development toolkit, and access to a compatible media server. That's it. Let's take a look at what SMIL is all about.

EXPLORING SMIL

The first time you view a SMIL production you'll be amazed, especially when you realize the sophisticated control the protocol offers. For example, by adding a time line to a presentation, you

can control when content is displayed and how transitions between various content types are handled. By defining layout regions, you can combine multiple forms of media and display them simultaneously. And by setting choices, you can even serve up different versions of the production based on the available bandwidth.

To see SMIL in action, you need a compatible player such as RealPlayer G2. Once you download and install the player, you can view SMIL presentations. The screenshot in Figure 2 shows a presentation from RealNetworks'

Screening Room, which includes a streaming video movie preview, a still image you can click on to open the home page, and a menu for accessing other movie previews.

Behind the scenes, the presentation's bandwidth needs are optimized based on the speed of your Internet connection. That is, the media files used by the presentation will depend on whether you're using a 28.8 modem or a high-speed connection such as a T1 line. The idea is to ensure that users enjoy the presentation regardless of their connection speed.

Normally, SMIL productions are delivered on channels, such as the Screening Room channel shown in Figure 2. Channels are like TV stations with content you can access on demand. Thus you determine the viewing schedule; you don't have to wait for some predefined time slot to arrive. Can you see how this technology could be used to free TV from its linear time line? Imagine being able to view any show in an entire season of "Dharma & Greg" whenever you want.

In a SMIL player such as RealPlayer G2, you subscribe to your favorite channels using a menu system, then you access those channels as easily as you access channels on your TV with a remote control. You simply click on the button of the channel you want to view. You can also access SMIL presentations from the Web. When you do this, your browser launches the SMIL player, which in turn displays the presentation. Some of the channels currently available include ABCNews Headlines, Silicon Spin from ZDTV, and The History Channel.

As amazing as it may seem, the key to SMIL isn't a complex programming language or some proprietary technology. Instead, the language relies on one of the Web's basic building blocks, XML (eXtensible Markup Language). SMIL is based entirely on XML, and because XML is defined using text markup tags, you could even create the layout and design of SMIL presentations using a standard text editor if you really wanted to.

Early work on SMIL began in December 1995. The specification went through many revisions before becoming an official recommendation of the World Wide Web Consortium





on June 15, 1998 (www.w3.org/tr/rec-smil). The specification defines SMIL as an application of XML that describes the layout and temporal behavior of multimedia presentations and the way media objects use hypertext links.

SMIL PLAYERS AND SERVERS

SMIL players are client applications that receive and display integrated multimedia presentations. Like other client applications, SMIL players are only one side of the equation. SMIL servers, which are responsible for providing content channels and serving presentations to clients, are also necessary.

Although SMIL itself is an open technology, some of the players and servers use proprietary techniques to handle multimedia streaming and encoding. This means you may be tied to a specific vendor for your SMIL publishing and distribution solution. There are essentially two types of players available: those that support SMIL and the standard multimedia formats used by SMIL presentations, and those that also support vendor-specific extensions. The most commonly used SMIL players are GRiNS (GRaphical iNterface to SMIL), HPAS (Hypermedia Presentation and Authoring System), RealPlayer G2, and RealPlayer Plus G2.

GRiNS combines a SMIL editor and player into an integrated system for working with SMIL presentations. You use GRiNS's editor component to create the markup necessary for SMIL presentations and the player component to play back presentations. GRiNS is provided free for noncommercial use and is available for Irix, Macintosh, SunOS, and Windows 95, 98, and NT from the National Research Institute for Mathematics and Computer Science in the Netherlands (www.cwi.nl/grins).

The HPAS player is designed as a Java applet for Netscape Navigator 4.03 or higher on Windows systems (other browsers currently aren't supported). Using this applet, you can play back SMIL and HSL (Hypermedia Synchronization Language) files. HSL is an alternative format for creating synchronized multimedia presentations available from Digital Equipment Corp. (www.research.digital.com/src/HPAS).

GRiNS and HPAS are fairly versatile, but RealNetwork's RealPlayer G2 and G2 Plus are in a league of their own. RealPlayer G2 is a full-featured player that supports SMIL as well as RealNetwork's streaming multimedia formats, such as RealText and RealPix. The player features terrific controls, is easily customizable, and best of all, is free. RealPlayer G2 Plus is an extended commercial version with enhancements for stereo playback and high-fidelity video. Both players are available

for Windows 95, 98, and NT or Macintosh from www.real.com/g2.

Delivering SMIL presentations is the job of specially configured multimedia servers such as RealServer from RealNetworks. These servers are configured to handle multiple forms of media including text, audio, video, and animation, and they understand hypertext links. Thus you can provide links within a presentation that access other presentations or other media files. For example, a History

STREAMING AND SMIL

With traditional multimedia files, such as MPEG video or AIFF audio, the playback device has to wait for the entire file to download before playback can begin. Streaming technology, on the other hand, lets multimedia servers send content in a continuous stream that can be decoded and played back shortly after being received. While it may take several minutes to download an MPEG video clip, a streamed video clip can begin to play within seconds. This capability is what makes streamed presentations enjoyable—even on a 28.8 modem.

To enable streaming, the developers of multimedia servers had to rethink the way data is transmitted over the Web, because

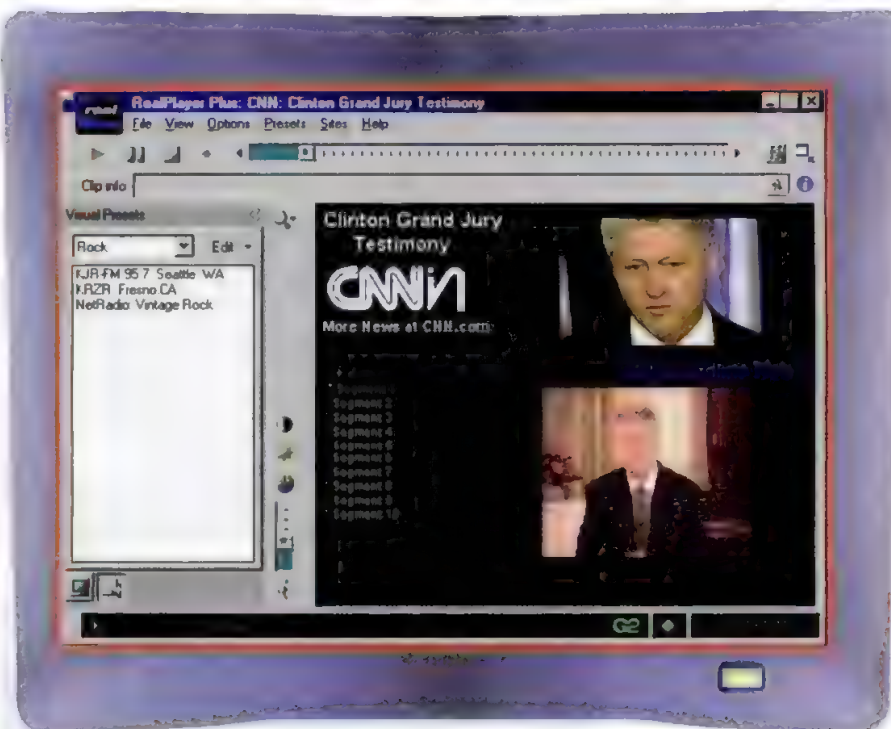


FIGURE 1: SMIL lets you comfortably access several multimedia files at once, even with a slow Internet connection.

Channel presentation on JFK could provide links to summary information on his life.

Because SMIL is a fairly new technology, there aren't many compatible servers. The showcase server available today is RealServer, which is available in a variety of configurations designed to fit specific needs. Because there's a version especially designed for ISPs, you may find that your ISP account can be upgraded to include support for SMIL presentations for a small additional charge. Keep in mind that to support SMIL, the RealServer version will need to be the latest G2-compliant version.

when it comes to synchronized media and streaming, HTTP isn't the best protocol to use. HTTP doesn't understand the temporal nature of streamed presentations, and as a result it can't serve files on a timed basis reliably. The solution is a new protocol that understands time, or more specifically *time stamps*. This new protocol is the RealTime Streaming Protocol (RTSP).

With RTSP, servers can keep track of when, where, and how content is transmitted. The protocol supports VCR-like functionality, such as play, fast-forward, pause, and stop, and it understands time stamps, which are used for

time-based seeking within a presentation. The protocol also supports multicasting for simultaneously broadcasting multiple files. You'll find RTSP at work in RealServer and in Netscape Media Server.

Microsoft has a streaming format of its own, called Active Streaming Format or ASF. But ASF requires you to stuff all your multimedia objects into a single file that is transmitted to the client packet by packet. RTSP, in contrast, uses the Web's standard URLs to reference the actual media objects, allowing users to access files as needed at runtime. This technique greatly simplifies the management and publishing process for multimedia presentations. For example, where ASF would require you to develop your complete multimedia presentation before you publish it, RTSP allows you to specify the URLs for files in the SMIL document and then create the actual media objects afterward. If you want to update a video clip in the presentation later, you would need to recreate the entire presentation with ASF, but with RTSP you simply save the updated video clip to the expected location.

CREATING SMIL PRESENTATIONS

Now let's take a look at how you create SMIL presentations. To make the instruction more practical, we'll use RealSystem G2 as the target client/server environment.

Before you dive in, I recommend that you change into your multimedia producer's hat—you're a producer now and you need to think like one. As you'll learn, producers spend an awful lot of time thinking about a project before they start producing it; your first task is to resist the impulse to start coding immediately. The SMIL file is the last thing you'll create, and you need to do a lot of planning beforehand. Specifically, you need to consider the types of media you'll use, the presentation's layout, and the time line for events within the presentation.

SMIL's media object tags let you include various media types in your presentations, and they're pretty self-explanatory. The `<animation>` tag supports animation tech-

nologies such as Shock Wave, which is used in a RealFlash file. The `<audio>` tag supports audio formats such as AIFF or SND files. The `<img>` tag is used for still images such as JPEG files or RealPix. The `<text>` tag is used for static text files; the `<textstream>` tag is used for streaming text files such as RealText. The

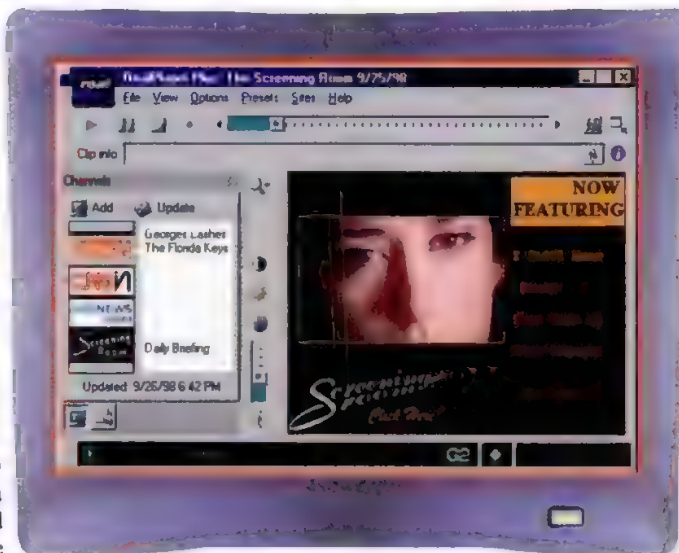


FIGURE 2: SMIL productions are delivered on channels, such as the Screening Room channel.

`<video>` tag is used with video clips. There's also a generic tag called `<ref>` you can use for other media types.

You can mix and match any of the available media types in your presentations. The only caveat is that your SMIL player must support the media formats you intend to use. Be forewarned that although a Web browser supports a particular format, a SMIL player may not. The current beta version of RealPlayer G2, for example, doesn't support GIF, which is the most widely used Web image format. Note, however, that if a player doesn't support the media format you want to use, you can probably export the media file to a different format. For example, you can export GIF images as JPEGs to use them in the beta version of RealPlayer G2.

You'll likely be importing and exporting a lot of file formats when you create your multimedia production, as you transfer standard formats to formats that can be streamed by the media server. As a rule, you'll want to transfer all standard animation, video, and audio file formats to streaming formats, such

as RealFlash, RealVideo, and RealAudio.

The presentation layout determines how you divide the screen real estate. Like Web browsers, SMIL players have a viewing area or window. When a SMIL presentation plays only one type of media at a time, the media can be displayed fully in the viewing window and automatically resized as necessary. But to play multiple media types simultaneously, you create miniwindows within the main viewing area, called *regions*.

You can think of regions as cells within a table. As with HTML tables, you can set the size and position of the viewing area as well as the size and position of the regions within it. Because the basic layout language for SMIL is consistent with Cascading Style Sheets, level 2 (CSS-2), you can precisely position regions using standard CSS-2 techniques (see "Taking Style Sheets to the Next Level," December 1, 1998). You can even assign IDs and z-order indexes to regions. This allows you to create regions that overlap (and if you want, to reposition regions much as you can objects in DHTML).

The code below shows how you might design your regions:

```
<layout>
<root-layout background-color="Red"
width="250" height="230"/>
<region id="mytextregion" top="5"
left="5" width="240" height="35"/>
<region id="myvideoregion" top="40"
left="30" width="180" height="180"/>
</layout>
```

In this example we size the main viewing area (identified with the `<root-layout>` tag) to 250 by 230 pixels and then create two regions within the viewing area: `MyTextRegion` and `MyVideoRegion`. `MyTextRegion` is positioned 5 pixels to the right of the main viewing area's left edge and 5 pixels down from the top of the main viewing area. `MyVideoRegion` is placed 30 pixels to the right of the main viewing area's left edge and 40 pixels down from the top of the main viewing area.

Once you've decided on the layout, you create a time line to coordinate the playing of media elements. SMIL provides two ways to play media elements: sequentially (one file right after another, normally in a single region) or in parallel, where multiple files can play simultaneously. When you present files in parallel, you can synchronize elements to create smooth transitions or to ensure certain elements always display together. For example, you could create descriptive text files that highlight key moments in a video clip and then synchronize the display of those files with the video clip's time line.



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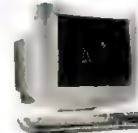
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Synchronization is at the core of SMIL, and as you would expect, SMIL provides many features for controlling the timing of media playback. You can set an explicit duration for a media clip: For example, you can stipulate that it will play for 2.5 minutes. You can time events according to the time line for the entire presentation: You can specify, for example, that a media clip should begin 1,500 milliseconds into the presentation and end 45 seconds into the presentation. You can also time events according to the internal time for a media clip, so you could skip the first 4 seconds of a clip and play the next 30 seconds. Moreover, you can specify the action to take when the end time elapses. For example, you can remove still images from the display or you can freeze video clips on the last frame.

The following code shows an example of event timing:

```
<par>
<video src="videol.rm" begin="8.5s"
end="30.1s"/>
<audio src="song1.ra" begin="30.1s"
clip-begin="5s" clip-end="15s"/>
</par>
```

When the presentation begins, the image Sunrise.jpg displays for 8.5 seconds. Then the video clip specified in the next line starts and runs until 30.1 seconds into the presentation. Finally, the audio clip Song1.ra begins. While the audio clip is playing, the Sunset.jpg image is displayed. Note that the audio segment uses the clip-begin and clip-end attributes to skip

the first 5 seconds and play the next 15 seconds of the clip.

Once you plot out the layout and time line, you'll probably want to add other features. As noted earlier, SMIL lets you serve up different versions of media files based on the available bandwidth. You set bandwidth choices with the system-bitrate attribute of the <par>, <seq>, and media object tags. This attribute tells the SMIL player to evaluate the bits-per-second rate used by the player against the rate you've set. If the player can achieve or exceed this rate, it will use the associated media files. Otherwise, the player looks for other files to use.

Figure 3 shows how to modify the earlier presentation to include low- and high-bandwidth choices. The <switch> tag tells the player it has a choice to make. Anytime you provide multiple routes through a presentation, you have to use this tag. Because bandwidth choices are evaluated in the order listed, the highest-bandwidth choice should come first.

You can also set language choices for media files, enabling you to create the layout and time line for a presentation just once—even if you want to serve an international audience. Language preferences are obtained from options set in the SMIL player. With RealPlayer Plus G2, you set the preferred language using the Content tab of the Preferences dialog. Display this dialog by selecting Preferences from the Options menu.

You set language choices with the system-

language attribute of the <par>, <seq>, and media object tags. The language codes for this attribute are taken from "Tags for the Identification of Languages," available by FTP from <ftp.isi.edu/in-notes/rfc1766.txt>. The following shows how you could specify English, French, and German versions for a presentation. Note that again the <switch> tag tells the SMIL player to make a choice.

```
<switch>
<video src="videol.rm" begin="15s"
end="120s" system-language="en"/>
<video src="videol.rm" begin="15s"
end="120s" system-language="fr"/>
<video src="videol.rm" begin="15s"
end="120s" system-language="gr"/>
</switch>
```

Your presentation will likely include hyperlinks as well. In this way, media files can provide links to other presentations so that when a user clicks on the link, a new presentation starts. Links can also target specific regions within a presentation. Thus you could click on a video to start a different video within the same presentation.

You can use image map coordinates for links as well, so you can create clickable hot spots for still images and video clips. Adding a new spin to linking, SMIL also lets you set temporal offsets for links: For example, you can specify that link A is valid for 15 seconds after the presentation starts, and after that only link B is valid. By combining temporal offsets and coordinates, you can create animations and videos that offer a feast of clickable hot spots.

When you've finished designing your presentation, you'll create the SMIL file that actually makes it happen. As we noted earlier, you could create the necessary markup file using your favorite text editor. SMIL editors are starting to debut, however, and two good ones to look at are T.A.G. Editor 2.0 for RealSystem G2 from Digital Renaissance (tag.digital-ren.com) and V-Active for RealSystem G2 from Veon (www.veon.com).

When your presentation is finished, you'll need to move the media files and the SMIL file to the media server. If the server supports all the media formats you've used, you're in business and should be able to view the presentation in your SMIL player without any problems. Enjoy! 

William Stanek is a frequent contributor to PC Magazine and author of several books, including FrontPage 98 Unleashed, Learn the Internet in a Weekend, and Increase Your Web Traffic in a Weekend. You can contact him at writing@tvpress.com.

```
<switch>
<!--Media files not assigned to regions for this example-->
<par system-bitrate="47000">
<!--isdn or higher -->

<video src="videol.rm" begin="8.5s" end="30.1s"/>
<audio src="song1.ra" begin="30.1s" clip-begin="5s" clip-end="15s"/>

</par>
<par system-bitrate="20000">
<!--28.8 modems-->

<video src="videolb.rm" begin="8.5s" end="30.1s"/>
<audio src="song1b.ra" begin="30.1s" clip-begin="5s" clip-end="15s"/>

</par>
</switch>
```

FIGURE 3: You can use the <switch> tag to get the player to use media files appropriate to the bandwidth.

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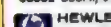
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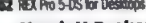
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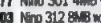
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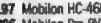


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40090	Zip Drive ADAP Insider	99.95
107017	Zip 250MB	199.95
103333	Zip Disk 10-Pack (Gray)	99.95
106303	Jaz Drive 1GB SCSI External (Refurbished)	199.95
102878	Jaz 2GB SCSI External	349.95
32556	Jaz 1GB Disk 3-Pack	269.95
47079	Jaz 2GB Disk 3-Pack	299.95

Kodak

101640	CD-R Media 30	\$59.95
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Memorex

52498	CD-R 74min 10-Pack	\$19.95
39020	CD-R 74min 100-Pack	149.95
48399	CD-RW Disc 5-Pack w/5 FREE CD-R Discs	49.95

Meridian Data

102404	8GB Snap! Server	\$949.95
102405	16GB Snap! Server	1699.95

Quantum

49043	DLT II 35/70GB Tape Cartridge	\$84.95
103062	3.2GB Fireball EX Ultra DMA HD	129
104069	4.3GB Fireball SE Ultra SCSI HD	289
104068	6.4GB Fireball SE Ultra SCSI HD	369
50067	8.4GB Fireball SE Ultra SCSI HD	489

Seagate

40529	2.1GB Mediatek IDE HD	\$115
51476	4.3GB Mediatek Ultra ATA HD	139
51475	6.5GB Mediatek Ultra ATA HD	159
50294	8GB TapeStar Int. SCSI Travan Tape Drive	219
54435	9.1GB Mediatek Pro Ultra ATA HD	239
54431	9.1GB Barracuda 9LP Ultra SCSI	539
55983	9.1GB Cheetah Ultra2 LVD HD	719
106519	18.2GB Barracuda Ultra Wide SCSI HD	999
56824	18.2GB Cheetah Ultra2 LVD HD	1299

Smart and Friendly

53407	4x12 CD Speedwriter SCSI Internal	\$349
53408	4x12 CD Speedwriter SCSI External	429.95
50101	4x26x CD-RW 426 SCSI External	599

Western Digital

45019	6.4GB Caviar Retail Packaged HD	\$149.95*
55997	8.4GB Caviar Retail Packaged HD	179.95*
101327	10.1GB Caviar Retail Packaged HD	229.95*
106485	13.0GB Caviar Retail Packaged HD	279.95*

UPS & POWER

Yamaha

102843	4x4x16 CRW4416S Internal SCSI	\$419.95
102844	4x4x16 CRW4416SX External SCSI	5499

American Power Conversion

10559	Back-UPS 280 (180 Watts)	\$69.95
56170	Back-UPS Pro 650 (410W)	279.95
56167	Back-UPS 500 (330W)	149.95
21929	Back-UPS Pro 1000 (670W)	379.95
56164	Back-UPS 300 (180W)	99.95
56165	Back-UPS Office 280	84.95
56189	Back-UPS Pro 420 (260W)	229.95

31466	Smart-UPS 700 Net (450W)	369.95
31469	Smart-UPS 1400 NET (950W)	629.95
31470	Smart-UPS 2200 NET (1600W)/PowerChute	899.95

Opti-ups

101381	280ES (280W)	99
101383	420ES (420W)	149

Tripp Lite

101100	Super 6 + Tel	\$11.99
21831	Super 7 Surge Suppressor	17.95
6786	Isobar 4 Ultra	44.95
9630	Isobar 6 Ultra	54.95
13147	Isobar 6 Ultra	64.95
25274	BC Internet 325 VA (filter mtr's 625 watts)	48.95
21044	BC Pro 1400 UPS (940 Watts)	419.95
45091	SmartPro 1400 NET UPS	494.95

NETWORKING

53094	3Com/USR External faxmodem	\$149.95
55204	Fast EtherLink XL with Wake Up 5-pack	389.95
51639	SuperStack II Dual Speed Hub 500 24-Port	949
53751	SuperStack II Switch 3300 24-Port	2300

Asant Technology

30297	10BaseT FriendlyNet 8-Port Hub	\$54.95
101124	FriendlyNet 10/100 8-Port Hub w/Bridge	299.95
100083	FriendlyNet 10/100 8-Port Switch	379.95

Bay Networks

103180	Baystack 350-24T 24-Port Switch	\$1999
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Belkin

37711	OmniView KVM 2-Port	\$179.95
32066	OmniView KVM 6-Port	269.95

Cisco

52027	Catalyst 2924XL 24-Port Switch	\$999
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DLink

53386	Ethernet PCMCIA	\$69.95
53371	Dual Speed 10/100BaseT SOHO 4-Port Hub	84.95
107126	10/100BaseT 5-Port Switched Hub	84.95
50457	10/100BaseT 8-Port Switched Hub	159.95

HP Networking

25882	Jet Direct EX Plus Print Server Ethernet LANs	\$229.95
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Intel

45834	PRO/100+ PCI Adapter 5-pack	\$369.95
103647	Create & Share Camera w/Software & Bunny Doll	99.95*
104535	Netport Express 3-Port Print Server	349.95*

Linksys

59629	10/100BaseTX PCI EtherFast LAN Card	\$29.95
59207	10/100BaseTX PCMCIA PC Card, 16-bit	74.95
59206	10/100BaseTX 8-Port Auto-Sensing Hub	149.95
105692	EtherFast 10/100 8-Port Switch	299.95
102024	StackPro II 16-Port 10/100 Hub w/FREE 5-Pack LAN Cards	429.95

Netgear

35404	FA310TX 10/100BaseT Fast Ethernet PCI Adapt.	\$24.95
47800	RT326 ISDN Router	269.95
53560	DS108 10/100BaseTX 8-Port Hub	178.95
53562	DS516 10/100BaseTX 16-Port Stackable Hub	499.95
48222	FS508 Fast Ethernet Switch 8-Port	599.95

Xircom

102700	Realport Ethernet 10/100	\$144.95
55424	RealPort 56K Modem & 10/100BaseT Ext. Adapt.	319.99

SOFTWARE

Adobe Systems

10678	Adobe Illustrator 8 Upgrade	\$118.95
100160	Adobe Illustrator 8	359.95
54674	Adobe Photoshop 5.0 Version Upgrade	189.95
54675	Adobe Photoshop 5.0	998.95
43823	Adobe Acrobat 3.0.1	189.95
32847	Adobe PageMaker 6.5 Version Upgrade	119.95
32845	Adobe PageMaker 6.5	549.95
55128	Adobe Premiere 5 Version Upgrade	189.95
55127	Adobe Premiere 5	589.95
102923	Adobe Graphic Studio	929.95

AutoDesk

104099	AutoSketch 6	\$94.95
103628	AutoCAD LT 98	399.95

Computer Associates

103262	ARCserveIT 6.6 for WinNT & FREE DoubleIT	\$389.95
103234	InoculateIT 4.5 Workgroup Ed. for WinNT	399.95
103263	ARCserveIT 6.6 w/ProPack & FREE DoubleIT	849.95

Corel

57535	Corel PrintOffice	\$69.95
49673	Corel Photo-Paint 8 Upgrade	94.95
55722	WordPerfect Suite 8 w/Dragon Nat. Speak Upg.	94.95
53662	Corel Ventura 8 Upgrade	194.95
55721	WordPerfect Suite 8 w/Dragon Nat. Speaking	299.95
48615	CorelDRAW 8 Upgrade	229.95
48619	CorelDRAW 8	429.95

Dragon

100242	Dragon Naturally Speaking Preferred	\$109.95
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FileMaker

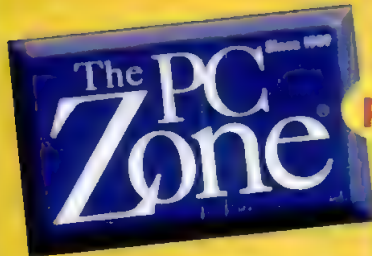
100346	NEW! FileMaker Pro 4.1	\$134.95*
54967	Home Page 3.0	89
54077	FileMaker Pro Developer Edition	479.95
54079	FileMaker Pro Server 3.0	899.95

IBM

50637	ViaVoice 98	\$139.95
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Lotus

102354	NEW! Organizer 5.0	\$54.95*
45962	Notes 4.6 Desktop/Client	87.95



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390 P2-266 32/4 0 24X 14.1 TFT 56K	#83793	\$2,490

ThinkPad 600 Series
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600 P2-233 32/3 2 24X 12.1 TFT 56K	#05146	\$2,740
600 P2-300 32/3 2 24X 13.3 TFT 56K	#57165	\$4,090
600 P2-300 32/3 2 24X 13.3 TFT 56K NT	#57166	\$4,160
600E P2-300 32/3 2 24X 13.3 TFT 56K	#57167	\$4,347

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Extreme performance mobile computing

770X P2-300 32/4 0 24X 14.1 TFT 56K NT	#57174	\$4,630
770X P2-300 32/4 0 24X 14.1 TFT 56K	#57173	\$4,733
770X P2-300 32/4 0 24X 14.1 TFT 56K NT	#57172	\$5,040
770X P2-300 32/4 0 24X 14.1 TFT 56K	#57171	\$5,111
Zip Drive for 770	#11907	\$199.05

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1700 P2-233 32/4 0 24X 12.1 CSTN	#00081	\$2,090
1700 P2-266 32/4 0 24X 13.3 TFT 56K	#00082	\$2,490
1700 P2-300 32/5 0 56K 14.1 TFT	#74884	\$3,290

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Armada 7800 Series
Pentium® II power for business!

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7800 P2-266 32/4 0 13.3 TFT NT	#01548	\$3,820
7800 P2-266 32/4 0 20CD 13.3 TFT	#01580	\$3,820
7800 P2-300 32/4 0 DVD 14.1 TFT	#74748	\$4,847

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1235 K6-266 32/4 0 24CD 12.1 HPA	#74652	\$1,499*
1240 MMX266 32/4 0 24CD 12.1 TFT	#74653	\$1,799*
1250 K6-300 32/4 0 24CD 12.1 TFT	#74658	\$1,989*

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Presario 1600 Series
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1610 P2-300 32/4 0 DVD 13.3 TFT	#74599	\$2,999*
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Presario 1800 Series
Large displays and stunning graphics!

1850 P2-266 32/4 0 12.1 TFT 56K W95	#07994	\$2,390
1855 P2-266 32/4 0 13.3 TFT 56K W95	#08017	\$2,490

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Satellite/Satellite PRO Series
Incredible, all-in-one design!

4000CDS P2-233MHz 32MB/4.1GB HD, 24X CD, 56K Fax Card, 12.1 SVGA DSTN	#00832	\$1,549
4000CDT P2-233MHz 32MB/4.1GB HD, 24X CD, 56K Fax Card, 12.1 SVGA TFT	#54323	\$1,699
4010CDS P2-266MHz 32MB/4.1GB HD, 24X CD, 56K Fax Card, 12.1 SVGA DSTN	#55308	\$1,699
4010CDT P2-266MHz 32MB/4.1GB HD, 24X CD, 56K Fax Card, 12.1 SVGA TFT	#54638	\$1,949
4020CDT P2-300MHz 64MB/6.4GB HD, 24X CD, 56K Fax Card, 13.3XGA TFT	#04685	\$2,699

Portage Series
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7000CT P2-266 32/4 3 56K 12.1 TFT	#27137	\$2,590
7000CT P2-266 32/4 3 56K 12.1 TFT NT	#54511	\$2,790
7010CT/W95 P2-300 32/4 3 12.1 TFT	#56545	\$3,190
7010CT/NT P2-300 32/4 3 12.1 TFT	#56546	\$3,390
3010CT MMX266 32/4 3 56K 10.4 TFT	#100243	\$1,910

Tecra Series
Long life, low cost, one solution!

8000 P2-233 32/4 0 24CD 56K 12.1 TFT	#72780	\$2,420
8000 P2-266 32/4 0 24CD 56K 13.3XGA TFT	#27285	\$2,990
8000 P2-300 32/4 0 24CD 56K 13.3XGA TFT	#74641	\$3,390
8000 P2-300 32/4 0 24CD 56K 14.1XGA TFT	#56548	\$3,890

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2105 P2-266MHz MMX 32MB/4.0GB HD 24X CD, 12.1 TFT	#102307	\$2,580
4101 P2-233MHz MMX 32MB/4.0GB HD 24X CD, 14.1 TFT	#16640	\$2,800
4151 P2-300MHz 32MB/4.0GB HD 24X CD, 14.1 TFT	#102309	\$4,550
7100 P2-266MHz 32MB/4.1GB HD 24X CD, 14.1 TFT	#18115	\$4,520
7150 P2-300MHz 64MB/6.1GB HD 24X CD, 14.1 TFT	#102310	\$4,940

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7775 P2-300MHz 64MB/6.4GB HD, 24X CD, 10/100 NIC, 56K, 13.3 XGA TFT	#08831	\$3,090

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E330 P2-233MHz 32MB/3.2GB HD 24X CD W95, 56K, 12.1 TFT	#55810	\$1,890
E335 P2-233MHz 32MB/3.2GB HD 24X CD W95, 56K 13.3 TFT	#56028	\$2,090
E340 P2-266MHz 32MB/4.0GB HD 24X CD W95, 56K, 13.3 TFT	#56033	\$2,490
E350 P2-300MHz 32MB/5.0GB HD 24X CD W95, 56K 13.3 TFT	#56182	\$2,770

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NoteBook Memory Configurations

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Items	ONLY
64MB RAM	#97435 \$136.95
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Items	ONLY
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64MB RAM	#97439 \$137.95

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Items	ONLY
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64MB RAM	#56325 \$178.95

IBM ThinkPad 600 Series

Items	ONLY
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300GL Celer 333MHz 32MB/3.2GB/MT	#57187	\$894.98
300GL Celer 333MHz 32MB/3.2GB/CD/DT	#57186	\$1,050
300GL P2-350MHz 32MB/3.2GB/DT	#57188	\$1,030

300GL P2-400MHz 64MB/6.4GB/NT/DT	#57180	\$1,540
300GL P2-450MHz 64MB/6.4GB/DT	#57181	\$1,850
300PL P2-350MHz 32MB/4.2GB/DT	#57181	\$1,340
300PL P2-350MHz 64MB/6.4GB/DT	#06727	\$1,530
300PL P2-400MHz 64MB/6.4GB/DT	#06721	\$1,840
300PL P2-450MHz 64MB/6.4GB/DT	#06730	\$1,670
300PL P2-450MHz 64MB/6.4GB/DT	#57182	\$1,850
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4400 Celer 333MHz 64MB/6.4GB/32CD/W95	#74689	\$1,070
4400 P2-350MHz 64MB/6.4GB/W95	#74690	\$1,122
6400 P2-450MHz 64MB/6.4GB/32CD/W95	#74692	\$1,353
6400 P2-450MHz 64MB/6.4GB/32CD/W95	#74693	\$1,388

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3200 P2-333MHz 32MB/3.2GB/W95	#05295	\$1,170
6400 P2-333MHz 32MB/6.4GB/24CD/W95	#05316	\$1,390

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3285 Celer 333MHz 32MB/4.0GB/32CD/56K	#00856	\$799.98*
5150 K6-350MHz 128MB/10GB/32CD/56K	#74658	\$999.98*
5170 P2-350MHz 128MB/10GB/32CD/56K	#74661	\$1,100*

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Brio 7100 Celer 333MHz 32MB/4.3GB/32CD/56K/W95	#97485	\$979.98
Brio 7176 P2-333MHz 32MB/4.3GB/32CD/56K/W95	#16730	\$1,190
Brio 8331 P2-350 32MB/6.4GB/32CD/W95	#16735	\$1,190
Brio 8532 P2-400 64MB/6.4GB/32CD/NT	#16747	\$1,580
Brio 8533 P2-450 64MB/6.4GB/32CD/W95	#100125	\$1,810

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Vectra V/8 P2-300MHz 32MB/3.2GB/32CD/W95/NT	#00818	\$1,400
Vectra V/8 P2-450MHz 64MB/6.4GB/32CD/W95/NT	#00284	\$2,024
Vectra V/8 P2-400MHz 64MB/6.4GB/32CD/W95/NT	#00240	\$1,740
Vectra V/8 P2-400MHz 64MB/6.4GB/32CD/W95/NT	#00243	\$1,790
Vectra V/8 P2-450MHz 64MB/6.4GB/32CD/W95/NT	#00270	\$2,129
Vectra V/8 P2-450MHz 64MB/6.4GB/32CD/W95/NT	#00278	\$1,940

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Kayak XA P2-350MHz 64MB/6.4GB/32CD/NT	#100140	\$2,399
Kayak XA P2-400MHz 64MB/6.4GB/32CD/NT	#100136	\$2,919
Kayak XA P2-450MHz 64MB/6.4GB/32CD/NT	#100141	\$2,819
Kayak XA P2-450MHz 64MB/6.4GB/32CD/NT	#100201	\$2,649
Kayak XA P2-450MHz 64MB/6.4GB/32CD/NT	#100204	\$4,149

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32X CD 3Com 10/100 W95	#100253	\$1.699
Equium V57100 P2-450 128MB/8 GB HD	#100267	\$1.699
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Umax P2-400MHz 64MB/8 GB HD 36X CD 56K 8MB AGP	#54647	\$1.299

Umax Bundled Kits		
Umax P2-400 w/17" Monitor	#55381	\$1.749
Printer and Scanner	#100254	\$1.499

Printers		
Inkjet		
Epson Stylus Color 440	#57148	\$149.98
Epson Stylus Color 640	#57149	\$199.98
Epson Stylus Color 740	#31720	\$279.98
Epson Stylus Color 1520	#40920	\$499.98
HP DeskJet 712C Printer	#45027	\$249.98
HP DeskJet 722C Printer	#45028	\$299.98
HP DeskJet 8950Cse	#60236	\$399.98
HP DeskJet 1120Cse	#57734	\$499.98
HP 2000 Professional Series Printer	#57731	\$799.98
HP OfficeJet 1175C Network-Ready - Print, Scan, Copy, Fax	#57744	\$899.98

Laser		
HP LaserJet 1100Cse Printer	#60286	\$399.98
HP LaserJet 6Pse Printer	#41036	\$799.98
HP LaserJet 4000N Network Printer	#53213	\$1.399
HP LaserJet 8100 Printer	#60319	\$2.599
Lexmark Optra K 1220	#60563	\$729.98
Lexmark Optra SC 1275	#49514	\$2.089
Lexmark Phaser 740 Color	#76546	\$1.995

Digital Cameras		
Nikon Coolpix 900s (1280 x 960)	#90636	\$749.98
Olympus D-340L (1280 x 960)	#32258	\$499.98
Olympus D-800L (1280 x 1024)	#53947	\$899.98
Olympus D-400L (1280 x 1024)	#96864	\$1.199
Olympus D-400L (1280 x 1024)	#96863	\$799.98
Kodak DC280 (1536 x 1024)	#73283	\$899.98
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#37261	4020CDT	300 PII MMX	64	6.4GB	24X	13.3" TFT	56K	\$2,699

Libretto

#39002	110CT	233 MMX	32	4.3GB	—	7.1" TFT	—	\$1,790
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Windows 95



- AMD K6-2/300 processor
- 48MB RAM 1.2GB HD
- 12.1" TFT Display
- 56K Modem 24X CD-ROM
- Windows 95

\$1,499
#38359

#38360	52BT	300 K6-2	32	4.0GB	24X	13.3" TFT	56K Win95	\$2,049
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COMPAQ Presario 500

- 333MHz Celeron Processor w/MMX technology or 350 to 450MHz Pentium II Processor w/MMX technology
- 32 to 64MB exp. to 384MB (256MB on Celeron model)
- 8.4 to 10GB Ultra ATA hard drive
- 40X or DVD-ROM
- Includes: MS Office 97 SMB
- Compaq Online Services
- Norton AntiVirus 4.0
- NetInternet Explorer 4.01
- 56K Modem

\$1,169
#38627

Now!



MS Office 97
SBE V2
Included!

Compaq Online Services Norton AntiVirus 4.0 NetInternet Explorer 4.01 56K Modem

Presario 500 Desktops

Order#	Model	Processor	RAM	HD	CD	Form	System	Price
#38627	310	333 Celeron MMX	32	4GB	40X	T/D	Win 95	\$1,169
#38645	330	350 PII MMX	64	10GB	40X	T/D	Win 95	\$1,419
#38648	330	450 PII MMX	64	10GB	DVD	T/D	Win 95	\$1,719

Desktop 300 Series

#36311	4300	333 Celeron MMX	32	4GB	—	T/D	Win 95	\$739
#36283	4300	380 Celeron MMX	32	4GB	—	T/D	Win 95	\$729
#36312	4400CDS	383 Celeron MMX	64	6.4GB	32X	T/D	Win 95	\$1,029
#36296	4300	350 PII MMX	64	4.3GB	—	T/D	Win 95	\$1,149
#36294	4400CDS	400 PII MMX	64	10GB	32X	T/D	Win 95	\$1,589
#36295	4400CDS	450 PII MMX	64	10GB	32X	T/D	Win 95	\$1,889

T/D=towerable design

\$818
#32888

HP Color Palmtop 660LX w/56K Modem

- 12MB RAM
- Windows CE 2.0
- 10MB ROM
- 56K Modem



COMPAQ Presario 220

333MHz Media GX II Processor w/MMX Technology

- 32MB RAM 32X CD
- 3.2GB Hard drive
- 56Kbps modem

Now!



\$599
#40880

Monitor sold separately

Order#	Model	Processor	RAM	HD	CD	Modem	Form	System	Price
#40851	520A	350 AMD K6-2	64MB	4GB	32X	56K	MT	Win 95	\$799
#40853	5220	380 AMD K6-2	64MB	8GB	32X	56K	MT	Win 95	\$999
#40854	5240	400 AMD K6-2	64MB	10GB	40X	56K	MT	Win 95	\$1,199
#37441	5190	400 AMD K6-2	128MB	10GB	DVD	56K	MT	Win 95	\$1,399
#40855	5630	450 PII MMX	128MB	10GB	DVD	AOS	MT	Win 95	\$2,199

*Price includes optional 20" display

*Price includes 20" monitor in rebate when you purchase an eligible Presario and sign up for a 30-day free trial of Compaq Easy Internet Access. Includes SuperDisk

UMAX PII 300MHz Processor w/MMX Technology

- 64MB RAM expandable to 384MB
- 8MB SGRAM
- 6.4GB Hard Drive
- 36X CD ROM
- 56K Modem
- Windows 95

\$869
#35210



#37486 AMD K6-2 350 64 6.4GB 36X 8MB 56K W95 \$999

COMPAQ Presario 500

- 233 - 300MHz Pentium processor w/MMX Technology
- 32 to 64MB exp. to 384MB (256MB on Celeron model)
- 8.4 to 10GB Ultra ATA hard drive
- 40X or DVD-ROM
- Includes: MS Office 97 SMB V2

\$2,019
#38629

Compaq Online Services Norton AntiVirus 4.0 NetInternet Explorer 4.01 56K Modem

Order# Model Processor* RAM HD CD Display Modem Price

#38629	120	233 PII MMX	32	3.2GB	24X	12.1" TFT	56K	\$2,019
#38654	140	266 PII MMX	32	4GB	24X	13.3" TFT	56K	\$2,499
#38655	160	300 PII MMX	32	5GB	24X	14.1" TFT	56K	\$2,999

Armadillo 1700 Series

#33230	1700	233 PII MMX	32	4GB	24X	12.1" TFT	56K	\$2,299
#33235	1700	266 PII MMX	32	4GB	24X	13.3" TFT	56K	\$2,799
#33591	1700	300 PII MMX	32	5GB	24X	14.1" TFT	56K	\$3,499

New Armadillo 700 Series

#31072	7000	266 PII MMX	64	5GB	20X	13.3" TFT	33.6K	\$3,699
#31073	7000	266 PII MMX	64	5GB	20X	13.3" TFT	—	\$3,299

Armadillo 3500 Series

#35380	3500	266 PII MMX	32	4GB	—	12.1" TFT	—	\$2,799
#35381	3500	300 PII MMX	64	6GB	—	13.3" TFT	—	\$2,699

COMPAQ Presario 1230

- 266MHz AMD K6 w/MMX technology
- 32MB RAM 12.1" HPA Display
- 4GB HD 56Kbps Modem
- 24X CD-ROM

\$1,399
#38011

Order# Model Processor* RAM HD CD Display Modem Price

#40901	1235	333 AMD K6-2	32	4GB	24X	12.1" TFT	56K	\$1,499
#40904	1280	333 AMD K6-2	64	4GB	24X	12.1" TFT	56K	\$1,799
#38007	1280	266 AMD K6-2	64	4GB	24X	12.1" TFT	56K	\$1,699
#32563	1855	266 PII	64	4GB	24X	13.3" TFT	56K	\$2,199
#38014	1810	300 PII	64	5GB	DVD	13.3" TFT	56K	\$2,799

*\$100 mail-in rebate from Compaq upon sign-up for 50-hour free trial of Compaq Easy Internet Access

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- 512KB L2 cache
- (128KB on Celeron models)

\$849
#36588

Monitor sold separately

Order#	Model	Processor	RAM	HD	CD	OS	Price
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#36601	627522U	333 Celeron	32MB	3.2GB	—	W95	\$879
#36604	627525U	333 Celeron	32MB	3.2GB	32X	W95	\$1,049
#36607	628513U	333 Celeron	32MB	3.2GB	—	W95	\$899
#36590	627557U	350 PII	32MB	3.2GB	—	W95	\$1,049
#36612	627575U	450 PII	64MB	6.4GB	32X	NT	\$1,649
#36613	627574U	450 PII	64MB	6.4GB	—	NT	\$1,549
#33327	627555U	350 PII	32MB	3.2GB	—	NT	\$1,099
#33328	627556U	350 PII	64MB	3.2GB	—	NT	\$1,149
#33329	627556U	400 PII	64MB	6.4GB	—	NT	\$1,299

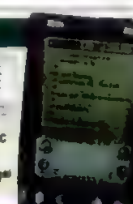
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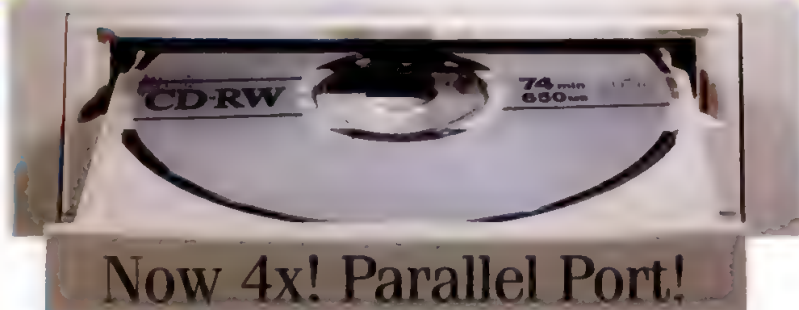
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*Or Pentium equivalent.
2x model also available. Standard EPP/ECP port required.
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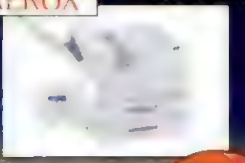
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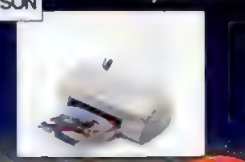
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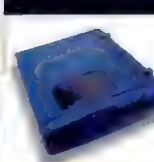
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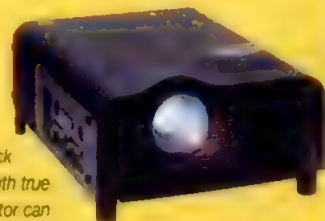
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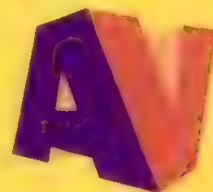
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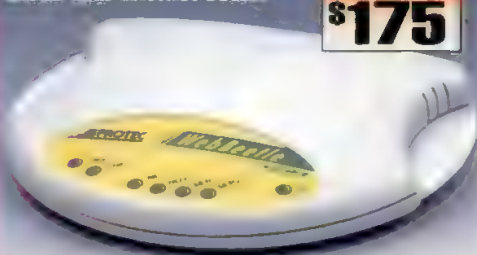
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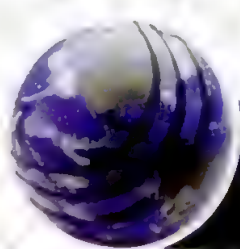
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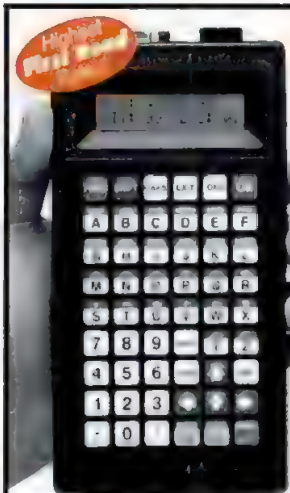
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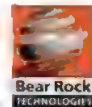
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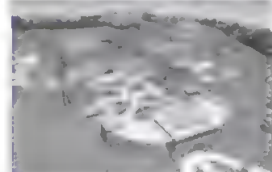
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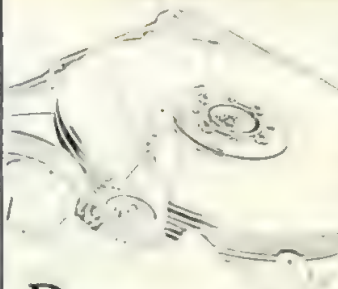
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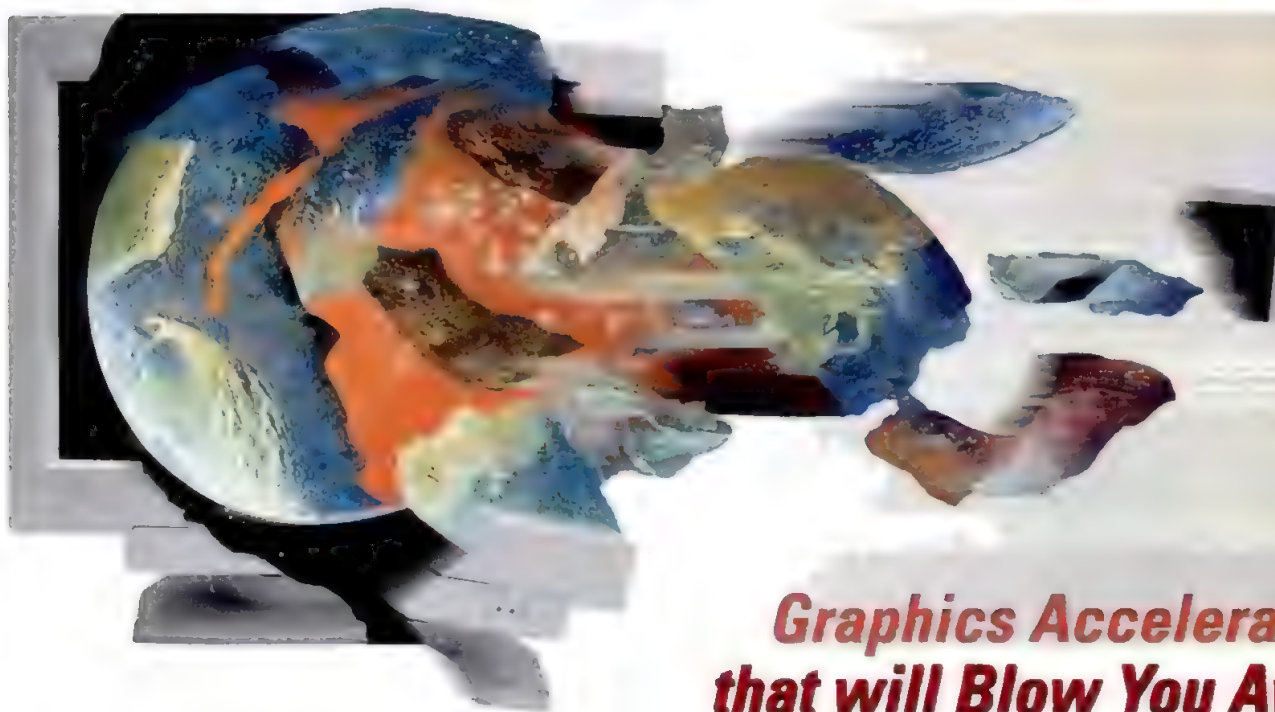
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AFTERHOURS

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COOKING SOFTWARE

What's Cooking?

By Sally Wiener Grotta and Daniel Grotta

Have a shelf full of cookbooks in your kitchen, but still making the same old meals (or eating mostly from Styrofoam containers)? Maybe it's time to clear some space on your counter for a computer. Cookbook software offers convenience combined with creativity, nutrition, and delicious new concoctions.

With a couple of mouse clicks, you can automatically scale recipes to serve any number of people, work out meal plans, save

special occasion menus, print out shopping lists, and analyze the nutritional values of ingredients, recipes, and meals. Some packages even have techniques videos or step-by-step instructions for cooking novices—or those of us who have forgotten how to fold in a beaten egg white.

COOKBOOKS 101

We reviewed four popular titles: Compton's Complete Interactive Cookbook, MasterCook Suite 4.0, Micro Cookbook Suite 5.5, and Micro Kitchen Companion, System 7. They follow similar conventions with regard to inter-

face and usability, and all proved both useful and appetizing.

Even on first glance, you'll notice that cookbook software isn't very different from printed cookbooks. Its primary purpose is to organize recipes. Therefore, each program calls its various folders of recipes "cookbooks," whether they are provided with the software or created by you. Of course, because the recipes are located in a central database, it's supereasy to search the entire collection according to very detailed criteria. Most of the programs offer powerful recipe searches by ingredients, occasion, preparation time, nutrition values (amount of fat, calories, sodium, sugars, and so on) and many other criteria. Micro Cookbook searches only on ingredient name or category,

meal plan, and recipe contents, however. All the programs provide nutritional information for each recipe. In addition, MasterCook, Micro Cookbook, and Micro Kitchen can sort recipes, so that you can see at a glance which dishes take the least time to prepare, have the lowest fat content, and so on.

TIPS AND TECHNIQUES

To save hassles, you can automatically scale recipes to serve any number of people. Videos of cooking techniques are included in Compton's, MasterCook, and Micro Kitchen. Compton's offers chefs' tips and a list of related recipes for each dish, as well as step-by-step instructions, including photos for some recipes. Though Micro Cookbook has neither illustrated tips nor videos, each recipe includes suggestions for related dishes. Micro Kitchen has a handy utility for side-by-side comparisons of any two recipes, but it would be more useful if it included a comparison of their relative nutritional contents. To help you find a dish, Compton's, MasterCook, and Micro Kitchen recipes can be bookmarked. Compton's and MasterCook also maintain a list of recently viewed recipes for each session.

Although adding your own recipes is rather quick and painless in these programs, the ease of getting to the correct dialog varies; MasterCook and Micro Kitchen are the most direct. To maintain the proper links for their search engines and nutri-

FROM TEE TO GREEN

Whether you're a hacker or an old pro, one of the five golf sims we review in this roundup is bound to please. *Page 278.*



PHOTOGRAPH BY THOM O'CONNOR. PHOTO ILLUSTRATION BY LOMA MORGENSTERN

AFTER HOURS

tional lookups, all programs except Micro Kitchen fill in matching terms, measurements, and names for ingredients as you type them. But Compton's insists that you use decimal measurements when you add to your ingredients list, even if your preferences are set to—and the final recipe displays—fractions.

Analyzing the nutritional values of your recipes is automatic in MasterCook but not possible in Compton's. Micro Cookbook calculates nutritional value with a single mouse click. Though Micro Kitchen analysis uses a time-consuming nutrition wizard, it also lets the user edit ingredients' names and measurements. With MasterCook, you can also maintain your wine inventory and add wine suggestions to your recipes.

MEAL PLANNING

Planning your meals is one of those time-consuming chores the computer has made much easier. MasterCook and Micro Cookbook have monthly menu-planning calendars into which you can drag and drop recipes or meal plans. Both can calculate total nutrition values for each day, so you can edit your plan until it better fits your dietary

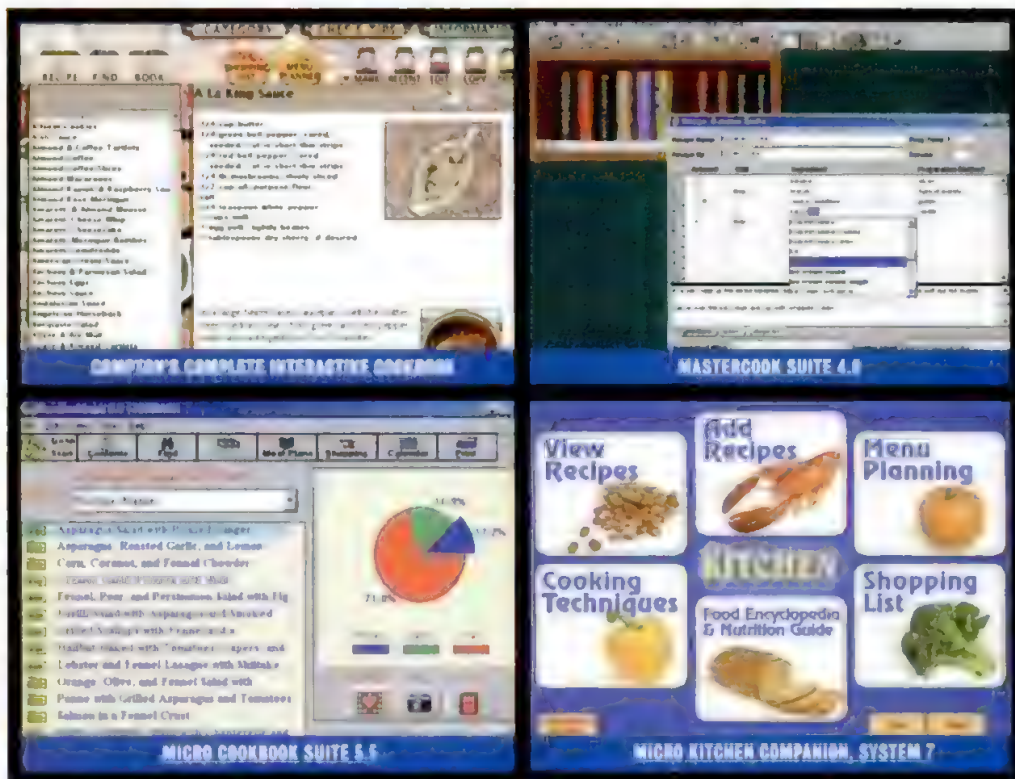
needs, but MasterCook is a bit more intuitive than Micro Cookbook. Compton's has a convenient meal wizard for planning menus course by course, but it works only on individual meals, rather than on an entire plan that spans a day or month. Even so, Compton's and Micro Kitchen

provide preplanned meals, as well as saving those you design.

Micro Kitchen has the most meal plan options and aids among these programs. In addition to one-week meal plans, it features a diabetic exchange meal plan option, though the recipes don't include exchange

values (see the sidebar "Special Diets"). It is also the only program in this roundup that has a personal worksheet to help you determine your dietary needs for your weight, age, and level of activity. But the worksheet is not integrated with the meal plan. After you have set up your meal plan, Micro Kitchen's task list organizes all the cooking chores for your menu so that everything is ready at the same time. In addition, Micro Kitchen has an Entertainment Calendar, which stores your guest list, menu, and related notes for any party you give.

Once you have selected your recipes and made your meal plans, the next step, of course, is to make sure you have all the ingredients you need. MasterCook and Micro Cookbook support simple drag-and-drop of recipes and meal plans into a printable shopping lists. Adding to a shopping list in Compton's requires only two additional mouse clicks, while Micro Kitchen's shopping list, like many of its functions, requires several more steps to do the



Cooking Software

	Compton's Complete Interactive Cookbook	MasterCook Suite 4.0	Micro Cookbook Suite 5.5	Micro Kitchen Companion, System 7
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List price	\$29.95	\$49.95	\$49.95	\$29.95
Recipes	2,500+	3,000	12,000	1,100+
Additional cookbooks	None	Graham Kerr Swiftly Seasoned 4.0, MasterCook CookingLight 4.0	John Ash's Wine Country Cuisine, Cookbook of Home Style Favorites (printed)	Cook It Light
Tips and techniques	1,000+, including 50 videos	50 videos	100 text-based tips	55 videos, 653 audio files
Adding recipes	★★	★★★★★	★★★★★	★★★★
Nutritional analysis	★★	★★★★★	★★★★★	★★★★★
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same thing. MasterCook and Compton's don't total identical ingredients (such as eggs) from different recipes, but Micro Cookbook and Micro Kitchen do. None of the programs automatically convert recipe measurements to standard packaging measurements—from cups of butter to pounds, for example.

COOKING AND THE WEB

Each program provides thousands of different recipes, but you can always add even more from the Web. MasterCook's link to SierraHome's home page offers

a library of free downloadable recipes. Micro Kitchen's Web link will connect you to Cook's Connection—a cookbook-CD-of-the-month club, with no fee and 30-day trial of any cookbook (with a money-back guarantee). LifeStyle's Cook's Connection also offers a forum for exchanging free recipes with other members, and the program has an import option for recipes you find on other Web sites. MasterCook and Micro Cookbook can import recipes from a handful of other cookbooks. Micro Cookbook also has a separate utility,

CookWorks Surf 'n Store, which will help you move a text file recipe into the program's proprietary format. With Compton's, you'll need to use the old standby of copying and pasting recipes into the Add Recipe window.

Recipe sharing is a time-honored tradition that has blossomed on the Internet. Although Micro Kitchen and Micro Cookbook export recipes to HTML, Micro Kitchen does the HTML conversions within the cookbook program. On the other hand, Micro Cookbook uses a separate but effective utility that requires

its own installation and isn't integrated into the main program.

Although MasterCook and Micro Kitchen support recipe e-mailing, neither works intuitively or automatically. In MasterCook you have to set up your e-mail, because the program doesn't pick up the information from your system's default service. Micro Kitchen handles e-mailing by letting you send text that you've saved to the program's clipboard in an e-mail memo after you open your e-mail program. In addition, Micro Kitchen provides a license to distribute up to ten of your

Kitchen Wizardry on the Web

Have a need to stock your kitchen full of gourmet tidbits? Are you a sucker for every cooking gadget from asparagus tongs to lime zesters? Look no further than the World Wide Web. Food-related sites are as numerous as the lumps in your great aunt's mashed potatoes (and much more appetizing). Everything you ever wanted to know about chopping, slicing, and dicing is waiting there for you to find it.

WWW.FOODTV.COM

Our personal viewing favorite, the Television Food Network has a site that enhances the visual experience with recipes, biographies, and culinary tips. The recipes are organized by show and are generally accurate—though wary cooks might want to adjust the times and quantities as they go along. (A flourless chocolate cake recipe from David Rosengarten's show "Taste" turned into a chocolate puddle owing to an unlikely time estimate on the Web recipe.) You can also ask CyberChef Georgia Downard about culinary dilemmas. The site is just starting to explore its e-commerce potential with a limited range of kitchen tools and cookbooks.

FOOD.EPICURIUS.COM

Epicurious has something for cooks of every level. The enormous recipe database is composed mainly of offerings from Condé Nast's *Bon Appétit* and *Gourmet* magazines. The cookbook reviews and columns are extensive, and menus are available for every occasion from romantic dinners à deux to 12-course wedding feasts. Several step-by-step guides with illustrations are available for ever-tricky recipes such as risotto and soufflés. The Playing with Your Food section includes etiquette lessons and 1,001 tips from the great chefs.

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It's hard to remember that only a short while ago, great

chefs were experienced only through their food. Nowadays, any chef with a wacky haircut and a witty repartee has a book deal and a chain of restaurants. StarChefs has interviews with all your favorite chefs, from the ever-present Emeril to Nobu Matsuhisa. You can learn about secret professional cooking techniques that will cause a stir at your next dinner party. Bulletin-board discussions of food and food trends let you have your say.

WWW.DIGITALCHEF.COM

A joint venture with the Culinary Institute of America, Digital Chef offers an extensive range of gourmet food and kitchenware. This well-organized site is easy to navigate and a pleasure to use. Gift options are available for many different budgets. Recipes tie into product promotions, but they tend to be relevant rather than intrusive. You can also create your own personalized online cookbook. This lets you access all

your favorite recipes at any time and scale them to the number of people you're cooking for.

WWW.EAT.COM

Big, name brand food corporations have finally caught on to the Web. Almost all of your favorite sauce or snack providers have Web pages awash with recipes and promotions. Lipton's Mama's Cucina is a fine example of this phenomenon. With recipes that use Ragù sauces in ways you never thought possible, Mama's Cucina is fun-filled and easy to use.

Here are a few more sites that might serve as a starting ground for your culinary exploration:

• dir.yahoo.com/Society_and_Culture/Food_and_Drink/Cooking/Recipes • www.balducci.com • www.bettycrocker.com • www.cooking.com • www.fritolay.com • www.globalgourmet.com • www.kraftfoods.com • www.littleyellowhouse.com • www.pillsbury.com—Sharon Nash



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cookbooks on floppy disks, with a light version of the program included so your friends can read and use the recipes. Compton's has no e-mail, HTML, or export options. All programs output to index cards and letter-size paper. MasterCook provides the most control over print layout, with Micro Kitchen a close second.

We found MasterCook Suite 4.0 the most comprehensive and easiest to use—a step ahead of the other three—making it our Editors' Choice. Version 5.0 of MasterCook should be available by the time you read this. LifeStyle Software Group's Micro Kitchen Companion, System 7, is uneven and often frustrating to use, but the program's meal planning is intelligent. Though you probably haven't given it much thought in the past, if you are a gourmet looking for a way to organize recipes and create interesting new menus, you may want to consider relocating your extra PC from its familiar home in the den or bedroom and bringing it into the kitchen.

Special Diets

Restricted diets—those that omit salt, fat, or sugar—needn't be boring. There are several software programs available to help plan appetizing menus and track diets for conditions from high blood pressure to diabetes.

NutriGenie offers numerous titles for special diets, in various languages. The titles include Kidney Disease Nutrition (\$91 list), Carbohydrate-Restricted Diet Meal Planner (\$41), Immune Deficiency Nutrition (\$41), Lower High Blood Pressure (\$51), and American Healthy Heart Diet (\$41). We looked at the Diabetes Meal Planner (\$61), which isn't as slick as the more mainstream programs we reviewed. In fact, it has the look and feel of a DOS or early Windows 3.0 program. But it does offer lots of information and helps patients take control of their diets. (NutriGenie, 800-242-4775, members.aol.com/nutrigenie.)

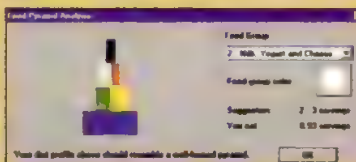
The Healthy Heart Cookbook 1.0 (\$15.95) is a combination cookbook and advisor, providing suggestions for cooking techniques and recipe

substitutions while encouraging you to change your eating habits gradually. Though Healthy Heart is an old program that lacks features we now expect from cookbook programs, it is still one of only a handful of titles that ad-

dresses the specific needs of heart patients. (LifeStyle Software Group, 804-794-7070, www.lifeware.com.)

Down-Home Diabetes Cookbook 4.1 (\$24.95) is a standalone program that works best when integrated into LifeStyle's Micro Kitchen Companion. All the recipes, which have been revised to fit a diabetic diet better, include exchange values, which can be added up in the meal plan. But to edit the recipes, you need to use them in the Companion. (LifeStyle Software Group, 804-794-7070, www.lifeware.com.)

For those of us who may not be on doctor-recommended diets but are trying to eat healthier, SierraHome's MasterCook Suite 4.0 and LifeStyle's Micro Kitchen Companion, System 7 both include light recipes cookbooks.—*SWG and DG*



GOLF SOFTWARE

Tee Time

By Michael E. Ryan
Looking for a great golf game? One of these five titles should fill the bill.

Links LS 1999

PC MAGAZINE EDITORS' CHOICE
Access Software's Links series has long been the favorite of serious, PC-packing golf fans, because of its realism and incredible depth of features. This year's version, Links LS 1999, is the best Links yet—good news for fans of the series and bad news for the rest of the field in the computer golf game genre.

With a significantly improved graphics engine, Links LS 1999 is now nearly as impressive to behold as it is to play.

Many of the paper-cutout problems—the result of 2-D objects and animations placed against a 3-D background—are gone, and the allover quality of the scenery is exquisite.

Game play is both challenging and enjoyable, though novices may find it a bit intimidating. This game was clearly designed for players who are comfortable on a real golf course.

Links LS 1999 provides four courses (including the St. Andrews Links Old Course) with support for more than 25 add-on courses. The game includes three different swing options (two-click, three-click, and mouse-driven) and over 30 modes of play. Additionally, Links LS 1999 includes a mode-of-play editor that allows you to create your own brand of golf.

Though it is tailored for

hard-core golf sim fans, players of all skills and interest levels should find plenty to like here.

Fox Sports Golf '99

Let's face it, at only \$10 a pop, Fox Sports Golf '99 is hard to find fault with. Though the game lacks the refinement and depth of its competitors, it looks good and plays pretty well, despite a

poor putting interface.

Like Jack Nicklaus 5, Fox Sports Golf '99 uses 3-D golfer animations. In fact, though the background graphics are rather plain, on the whole the look of this game is surprisingly smooth and convincing. Game play is very easy to learn and moves along much faster than the other games reviewed here.

The game includes eight courses, four swing options—including one designed specifically for laptop use—and five modes of play. It's a bit rough around the edges and lacks the realism provided by most of the competition, but it's a real bargain and can be lots of fun.

Jack Nicklaus 5

Though Jack Nicklaus 5 was edged out by Links LS 1999's depth of play and



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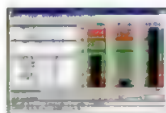


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extraordinary realism, it remains one of the finest golf games around. It offers exciting game play and includes an excellent course designer.

Using well-rendered 3-D golfers, Nicklaus avoids that paper-cutout look found in most golf games. In fact, the graphics in Jack Nicklaus 5 are slightly better than Link LS 1999. It runs slower than any of the other games, however.

Jack Nicklaus 5 features 10 courses and supports over 125 free downloadable add-on courses. The game offers three different swing options (two-click, three-click, and mouse-driven) and 13 modes of play. It's fairly easy to play but realistic enough to please most serious golf fans.

Microsoft Golf 1999

Another markedly improved version of a long-running series, Microsoft Golf 1999 is a solid



game that comes up just a little short in the face of top-flight competition. The graphics and game play are above average but not quite as good as those offered by Jack Nicklaus 5, Links LS 1999, or Tiger Woods 99.

In terms of graphics, Microsoft Golf 1999 edges out Fox Sports Golf '99 as the least impressive game in the group. Both golfers and objects look

extremely flat against the background, and the game's skewed swing meter can be rather difficult to master. Also, the postshot commentary is overly sarcastic and annoying.

The game includes seven courses, four swing options, and five modes of play. Microsoft Golf 1999 should appeal to longtime fans of the series, but there are better golf games out there.

Tiger Woods 99

Electronic Arts is once again a serious contender for the computer golfing throne. Though Tiger Woods 99 is not quite as impressive or as realistic as Links LS 1999, it is a remarkably fun and easily approachable game.

Tiger Woods 99 uses a decent 3-D graphics engine with a number of superb camera angles. Still, the game falls victim to paper-cutout problems, because of the 2-D animations of Tiger and the game's seven other pro golfers. Much of the scenery also looks flat, and the water effects are often just plain ugly.

The game includes three courses (plus support for ten add-on courses), two different swing options, and nine modes of play. Tiger Woods is not the best golf game on the market, but it's a great choice for those of us who are novices at real golf and computer games. **PC**

Coming Up

What's in the Next Issue of *PC Magazine*

Fixing Windows

Does your Windows PC crash too much? Ever want to make it run faster? Having trouble getting a new scanner or drive running? Then we'll have the goods for you! We'll tackle all the problems users run into most often, and lots of little nagging ones too—everything you'll need to make Windows run better.

Software for Hand-Held Computing

Hand-held PCs are here to stay. Next issue we'll run our first major roundup of software for Palm and Windows CE devices.

Security/Biometrics

Biometric security devices go beyond passwords and smart cards to help curtail unwelcome access to PCs and network servers. But are they really more secure and convenient than the mechanisms they replace? PC Magazine Labs tests a range of devices, with some startling conclusions.

Notebook PCs

This spring will see the debut of Intel's mobile Celeron chip and AMD's mobile K6-2. These new chips won't break any performance records, but they should bring down the prices of many mainstream notebooks.



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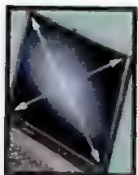
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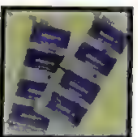


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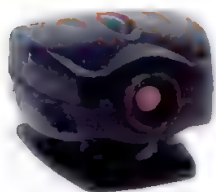
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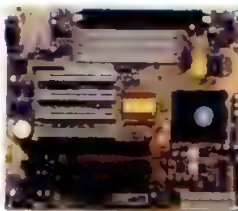
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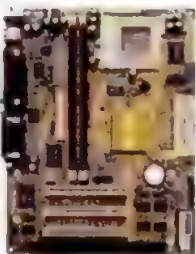
Tiger 571 Motherboard Features At-A-Glance

Form Factor: **Baby AT** On Board Video: **4MB** ISA Slots: **3**
Processor: **Socket 7** On Board Audio: **YES** Memory: **DIMM or SIMM**
Bus Speed: **Up to 63MHz** PCI Slots: **4** Max Memory: **384 MB**

Tiger 595 Micro-ATX Socket 7

Motherboard & Case: Motherboard mounted in dual-cooling fan mini case; 140 Watt power supply, cables, manual

Pre-Assembled Kits: Motherboard in dual-cooling fan mini case; 140Watt power supply, keyboard, speakers, mouse, microphone, 64-bit video, 56KFlex fax/modem, 1.44MB floppy drive, 24X CD-ROM, Wave Table sound.



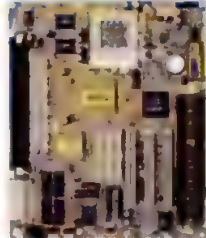
Tiger 595 Motherboard Features At-A-Glance

Form Factor: **Micro ATX** On Board Video: **4MB PCI** ISA Slots: **1**
Processor: **Socket 7** On Board Audio: **YES** Memory: **DIMM**
Bus Speed: **Up to 63MHz** PCI Slots: **3** Max Memory: **256 MB**

Tiger 590 AT AGP Super Socket 7

Motherboard & Case: Motherboard mounted in dual-cooling fan case, 200 Watt power supply, cables & manual

Pre-Assembled Kits: Motherboard in dual-cooling fan case; 200 Watt power supply, keyboard, speakers, mouse, microphone, 3D AGP video, 56KFlex fax/modem, 1.44MB floppy drive, 24X CD-ROM, Wave Table sound.



Tiger 590 Motherboard Features At-A-Glance

Form Factor: **AT** On Board Video: **4MB AGP** ISA Slots: **2**
Processor: **Super Socket 7** On Board Audio: **YES** Memory: **DIMM or SIMM**
Bus Speed: **Up to 100MHz** PCI Slots: **3** Max Memory: **256MB**

Tiger 767 AT, 760 ATX Slot 1

Motherboard & Case: Motherboard mounted in dual-cooling fan case; cables & manual

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Tiger 767 Form Factor: **AT** • CPU: **Slot 1** • Bus Speed: **Up to 100 MHz** • On Board Video: **4MB AGP** • On Board Audio: **YES** • PCI Slots: **4** • ISA Slots: **1** • Memory: **DIMM** • Max Memory: **768 MB**

Tiger 760 Form Factor: **Micro ATX** • CPU: **Slot 1** • Bus Speed: **Up to 100MHz** • On Board Video: **4MB AGP** • On Board Audio: **YES** • PCI Slots: **3** • ISA Slots: **1** • Memory: **DIMM** • Max Memory: **768 MB**

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Tiger 571 AT including Wave Table sound and video	AMD Up to K6-300 & K62-266 Intel Pentium up to 233 MMX IBM/Cyrix up to P300	MB1-C-1B	\$77.99	\$69.99	BB1-C-1B	\$124.99	\$114.99	KT1-C-1B	\$219.99	\$202.99
Tiger 590 AT Super Socket 7 with AGP Technology and SoundPro Sound	All AMD Up to K62-400; Intel Pentium up to 233 MMX; IBM/Cyrix up to P300	MB1-E-4A	\$87.99	\$79.99	BB1-E-4A	\$139.99	\$129.99	KT1-E-4A	\$229.99	\$211.99
Tiger 595 Micro-ATX Socket 7 with Sound & Video; 512KB Pipelined Burst cache	All AMD Up to K62-266; Intel Pentium up to 233 MMX IBM/Cyrix up to MII 350	MB1-E-3A	\$77.99	\$69.99	BB1-E-3A	\$109.99	\$99.99	KT1-E-3A	\$199.99	\$183.99
Tiger 767 AT Slot 1	Celeron up to 333MHz Intel Pentium II up to 450MHz	MB1-E-5A	\$99.99	\$91.99	BB1-E-5A	\$154.99	\$142.99	KT1-E-5A	\$249.99	\$229.99
Tiger 760 Micro ATX Slot 1	Celeron up to 333MHz Intel Pentium II up to 450MHz	MB1-E-6A	\$99.99	\$91.99	BB1-E-6A	\$139.99	\$129.99	KT1-E-6A	\$239.99	\$229.99

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abort. retry. fail?

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Edited by Don Willmott

But be sure to dust
your monitor first.
(Excite.)

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We Were Wondering Where Priscilla Went

Here's a little too much information from an author biography in *Handheld PC* magazine: "For six years John was the Social Studies Department Head and Technology Coordinator at the Beaufort-Jasper Career Education Center... He has a Masters Degree in Education from Converse College and lives in Bluffton, South Carolina, with my wife Priscilla and three-year-old son Drew."

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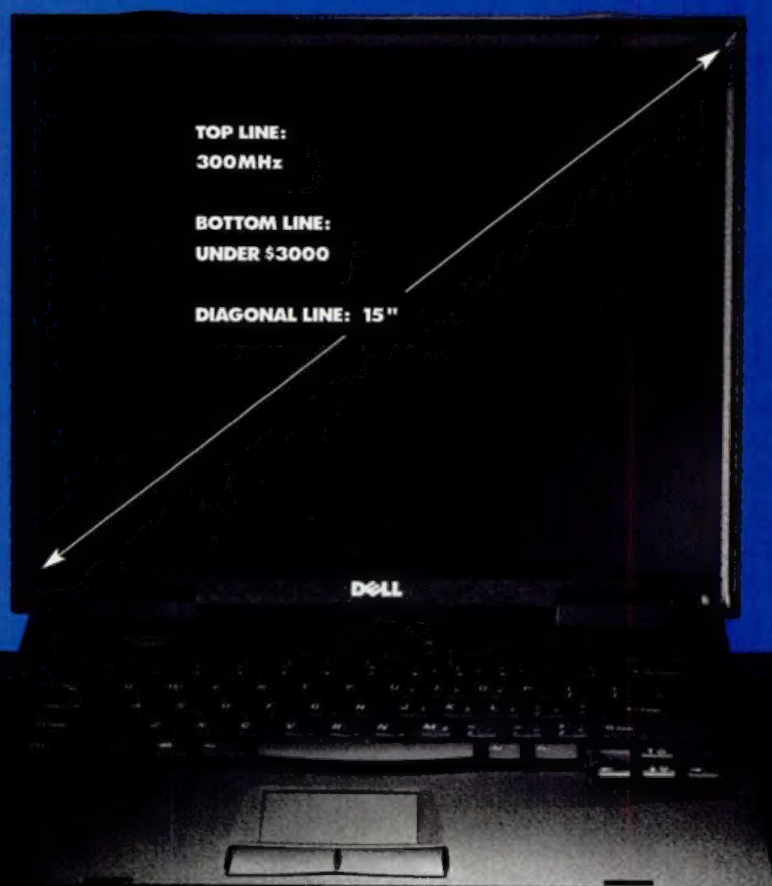
"So far he's called up a cobra, 2 pythons, and a bunch of skinks, but still not the file we're looking for."

Beep-Beep

Faithful reader Steve Puffenberger reports that real-estate agents in his area are confused by the availability of Road Runner high-speed home cable Internet access. One agent talked about a house-hunting computer professional who was "very dedicated to watching Road Runner cartoons" and interested in knowing if the local cable company "ran a 24-hour Road Runner channel." Funny enough to make you howl like a coyote.

If your entry is used, we'll send you \$50 and a *PC Magazine* T-shirt. Send your entries to Abort, Retry, Fail?, *PC Magazine*, One Park Ave., New York, NY 10016-5802. Winners this issue: John Broughton, J.P. Frankenhuis, Michael Guay, Greg Perry, Steve Puffenberger, and David Ross.

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AM Cache rd Drive able, .26dp) T 3D AGP D-ROM Drive 0" PCI n rect™ Internet	• 128MB 100MHz SDRAM • 512KB Integrated L2 Cache • 8.4GB Ultra ATA Hard Drive • 17" (16.0" viewable, .26dp) Trinitron® 1000HS Monitor • 8MB STB nVidia 3D AGP Graphics Card • 40X Max™ Variable CD-ROM Drive • Crystal 3D 64V Wavetable Sound • harman/kardon HK-195 Speakers • 3Com 3C905B 10/100 NIC • MS IntelliMouse ★ Upgrade to a NEW 12.9GB Ultra ATA Hard Drive, add \$79. ★ Upgrade to a NEW 19" (18.0" viewable, .26dp) Trinitron P990 Monitor, add \$169.	• 64MB 100MHz SDRAM • 512KB Integrated L2 Cache • 8.4GB Ultra ATA Hard Drive • 17" (15.9" viewable) 1000LS Monitor • 8MB ATI 3D AGP Graphics • 40X Max™ Variable CD-ROM Drive • Yamaha XG 64V Wavetable Sound • harman/kardon HK-195 Speakers • APC SurgeStation ProBT2 • Logitech First Mouse+ Wheel (PS/2v) ★ Upgrade to 96MB 100MHz SDRAM, add \$69. ★ Upgrade to a NEW 12.9GB Ultra ATA Hard Drive, add \$79. ★ 3Com 3C905B 10/100 NIC, add \$50.	Network-Designed Desktop • 32MB SDRAM • 128KB Integrated L2 Cache • 8.4GB Ultra ATA Hard Drive • 15" (13.7" viewable) 800F Monitor • 8MB ATI 3D AGP Graphics • 32X Max[®] Variable CD-ROM Drive • Integrated Intel 10/100 Ethernet Controller • Logitech First Mouse+ Wheel (PS/2v) ★ Upgrade to 64MB SDRAM, \$59. ★ Upgrade to a 17" (15.9" viewable) 1000LS Monitor, add \$59. ★ Upgrade to 3-Year Next-Business-Day On-site^Δ Service, add \$99. ★ Iomega Zip 100MB Internal Drive with Two Cartridges, add \$99.
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